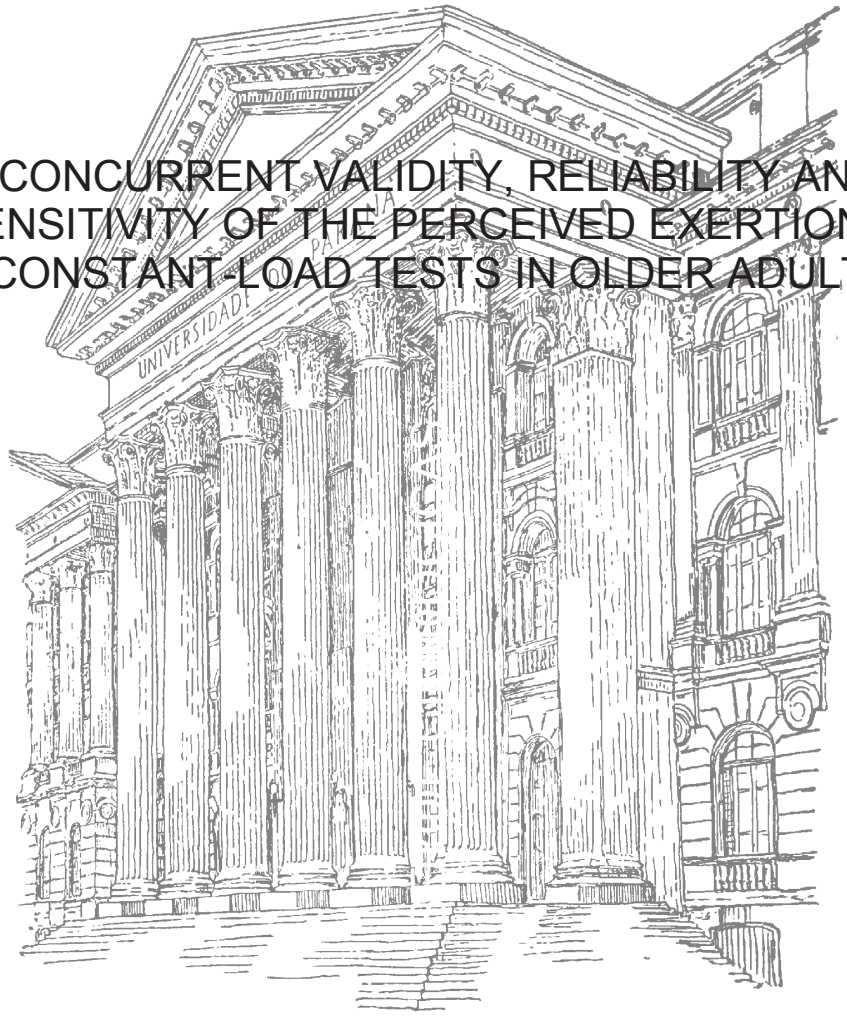
PAULA BORN LOPES

CONCURRENT VALIDITY, RELIABILITY AND SENSITIVITY OF THE PERCEIVED EXERTION IN CONSTANT-LOAD TESTS IN OLDER ADULTS



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PAULA BORN LOPES

CONCURRENT VALIDITY, RELIABILITY AND SENSITIVITY OF THE PERCEIVED EXERTION IN CONSTANT-LOAD TESTS IN OLDER ADULTS

Tese apresentada ao curso de Pós-Graduação em Educação Física, Setor de Ciências Biológicas, Universidade Federal do Paraná, como requisito parcial à obtenção do título de Doutor em Educação Física.

Orientador: Prof. Dr. Gleber Pereira

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“There is nothing impossible, even the world impossible says ‘I M POSSIBLE’”. Audrey Hepburn

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RESUMO

O nível de dependência na realização de atividades da vida diária é um fator determinante para a qualidade de vida e a sua mensuração é muito importante para diagnosticar e prevenir o aumento do nível de dependência em realizar as atividades da vida diária em idosos. Pode ser medido através de questionários autopercebidos e previstos através de testes baseados em desempenho. A percepção subjetiva de esforço (PSE) em testes de carga constante também podem ser usados para diferenciar a dependência na realização de atividades da vida diária, porém é crucial medir a validade, confiabilidade e sensibilidade deste instrumento antes de usá-lo. Assim, o objetivo da presente tese foi verificar a validade, confiabilidade e sensibilidade da percepção de esforço para diferenciar a dependência na realização de atividades da vida diária em idosos. Para atingir esse objetivo, dois estudos diferentes foram realizados. O primeiro estudo teve como objetivo verificar a habilidade da percepção de esforço em testes de carga constante de diferenciar o nível de dependência na realização das atividades da vida diária em idosos. É considerado um estudo de cunho transversal. Os idosos realizaram três dias de testes. Os testes baseados em desempenho e os questionários de atividades básicas e instrumentadas da vida diária foram usados como critério para fazer a validade concorrente com os testes de carga constante da PSE. A PSE em testes de carga constante foram realizados após 1 minuto de flexão de cotovelo e sentar e levantar de uma cadeira e um metrônomo foi utilizado para controlar a velocidade. A validade concorrente da PSE em testes com carga constante foi testada com uma correlação de Spearman usando os questionários como critério. Os resultados indicaram que a PSE de flexão de cotovelo em teste constante apresentou validade concorrente para as idosas e que a PSE de sentar e levantar apresentou validade concorrente para homens e mulheres idosas. Os dois testes de carga constante da PSE mostraram confiabilidade ($p<0.05$). As análises da curva ROC foram calculadas para detectar a acurácia diagnóstica da PSE em testes de carga constante para diferenciar o idoso independente do dependente na realização de atividades de autocuidado. Os testes de carga constante da PSE apresentaram precisão diagnóstica para diferenciar o nível de dependência na realização de atividades da vida diária em idosos. A PSE de 13 no teste de flexão de cotovelo foi avaliada como um ponto de corte para as idosas e a PSE de 11 no teste de sentar e levantar foi considerada um ponto de corte para as mulheres e homens idosos. O segundo estudo teve como objetivo verificar a sensibilidade da percepção de esforço nos testes constantes para verificar a dependência na realização das atividades da vida diária após um período de treinamento multicomponente para idosos. O estudo foi considerado um estudo longitudinal. Os testes baseados em desempenho (sentar e levantar, flexão de cotovelo, levntar ir e voltar, 4 metros de caminhada), os questionários Katz e Lawton que avaliam as atividades básicas e instrumentadas da vida diária e a PSE nos testes de carga constante forma testados pre e após o treinamento. Após 13 semanas de treinamento multicomponente duas vezes na semana nos idosos institucionalizados (MT, 69.2±7.4, IMC=28.0±6.1) e o grupo controle que não participou de nenhum programa de exercícios (CG, 72.4±8.9, IMC=27.9±5.5). Cada dia de treinamento multicomponente foi dividido em 4 partes principais: aquecimento, treinamento de resistência, treinamento aeróbico e volta à calma. Os resultados mostraram que os testes da percepção de esforço com carga constante parecem ser sensíveis para diferenciar a dependência em realizar as

atividades da vida diária após um período de treinamento multicomponente em idosos institucionalizados. As respostas dos idosos na PSE em testes de carga constante foram menores ($p<0.05$) no grupo do treinamento multicomponente do que no grupo controle após o período de treinamento. No entanto, a PSE de flexão de cotovelo apresentou essa redução nas idosas e a PSE de sentar e levantar apresentou essa redução nas mulheres e homens idosos. Após os resultados desses dois experimentos pode-se sugerir que a PSE em testes de carga constante podem ser uma alternativa para diferenciar o nível de dependência na realização de atividades da vida diária em idosos. Além disso, a PSE em testes de carga constante da PSE podem ser um ótimo instrumento para avaliar os efeitos na dependência na realização de atividades da vida diária após um período de treinamento multicomponente em idosos institucionalizados. A percepção de esforço em testes de carga constante apresentou validade, confiabilidade e sensibilidade para idosos.

Palavras chaves: idosos, propriedades psicométrica, capacidade funcional e sensibilidade

ABSTRACT

Dependence level in performing self-care activities is a determining factor for the older adults quality of life and its measurement is very important to diagnose and to prevent the increase in dependence level to perform activities of daily living in older adults. It can be measured through self-perceived questionnaires and predicted through the performance-based tests. Rating of perceived exertion (RPE) in constant-load tests could also be used to differentiate the dependence level in performing self-care activities, however it is important measuring validity, reliability and sensitivity after using this instrument. Thus, the aim of the present thesis was to verify concurrent validity, reliability and sensitivity of the perceived exertion in constant-load tests to differentiate dependence level in performing activities of daily living in older adults. To achieve these goal, two different studies were done. The first study aimed to verify the ability of the perceived exertion in constant-load tests had to differentiate dependence level in performing the activities of daily living in older adults. It is considered a transversal cross-sectional study. The older adults performed three testing days. The performance-based tests and the basic and instrumental activities of daily living questionnaires were performed. The RPE in constant-load tests were performing after 1 minute of arm-curling and sit to stand test with a metronome to control the velocity. The concurrent validity of the RPE in constant-load tests was tested with a Spermand correlation using the questionnaires as a criterion. The results indicated that the RPE arm-curling presented concurrent validity to older women and the RPE sit to stand constant-load test presented concurrent validity to older men and women. The RPE in constant-load tests showed good reliability. The ROC curve analyses have been calculated to detect the diagnostic accuracy of RPE in constant-load tests to differentiate the independent from dependent older adults in performing self-care activities. The RPE in constant-load tests presented the diagnostic accuracy to differentiate dependence in performing self-care activities in older adults. The 13 RPE in the arm-curling test showed as a cut-off point for older women and the 11 RPE in sit to stand test as a cut-off point to older women and men. The second study aimed to verify the sensitivity of the perceived exertion in constant-load tests to differentiate the dependence level in performing self-care activities improvements after a period of multicomponent training in older adults. The study was considered a longitudinal study. The performance-based tests (sit to stand, arm-curling, time up and go test, 4 meter walking), the Katz and Lawton questionnaires that evaluate basic and instrumental activities of daily living and RPE in constant-load tests were tested pre and post training. After 13 weeks of multicomponent training twice a week in institutionalized older adults (MT, 69.2±7.4, BMI=28.0±6.1) and a control group that did not participated in a exercise program (CG, 72.4±8.9, BMI=27.9±5.5). Each multicomponent training session was divided into four main parts: warm-up, resistance training, aerobic training and cool down. The results showed that the perceived exertion in constant-load tests presented sensitivity to differentiate the

dependence level in performing self-care activities after a period of multicomponent training in institutionalized older adults. The older adults responses in RPE in constant-load tests were lower in multicomponent training than control group after the period of training. Moreover, the RPE arm-curling responses presented decrease in older women and the RPE sit to stand presented reduction in the older women and men after the period of training. After the results of these two experiments studies it have been suggested that RPE in constant-load tests can be an alternative to differentiate dependence level in performing self-care activities in older adults. In addition, RPE in constant-load tests can be a adequate instrument to assess the effects of training period on the dependence in performing self-care activities in institutionalized older adults. Therefore, the perceived exertion in constant-load tests presented concurrent validity, reliability and sensitivity in older adults.

Keywords: elderly, psychometric proprieties, functional capacity, sensitivity

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CHAPTER 1

General Introduction

1.1 General Introduction

The world's population is ageing at an exponential rate. This rate has been accompanied by an increased dependence in performing daily living activities, which is considered a public health problem (MLINAC; FENG, 2016). One million and four hundred thousand of older adults above 65 years presented dependence in five to seven basic daily living activities, which 59% lived in a institutionalized place (CAMARANO, 2010). Decreased functioning in physical, cognitive or sensory domains must have a major effect on an older adult's life and the progression of functional capacity deterioration can affect the individual ability to live independently (MILLÁN-CALENTI et al., 2010). Therefore, once the number of older adults and the dependence in functional capacity are increasing, preventive and diagnostic instruments to evalute such dependence are crucial. A large proportion of the world's disabled population lives in developing countries, making the measurement of dependence in performing self-care activities even more important for preventing it in older adults (PALMER; HARLEY, 2012).

Dependence in performing self-care activity can be predicted through self-perceived instruments and through performance-based tests (GURALNIK et al., 1995). The questionnaires are an example of self-perceived instruments and have been developed in several studies (DUARTE; DE ANDRADE; LEBRÃO, 2007; MCDOWELL, 2006; SANTOS; VIRTUOSO JÚNIOR, 2008). They evaluate the capacity of independence in performing basic and instrumental activities of daily living (GILL; WILLIAMS; TINETTI, 1995; YANG; DING; DONG, 2014). Performance-based tests are widely adopted in evaluating the mobility, strength, agility and

balance problems of older adults (RIKLI; JONES, 1999). The performance-based tests battery was created to predict the functional capacity in older adults through a cross-section designed and standardize values (RIKLI; JONES, 2013). The performance-based tests presented concurrent validity, reliability and sensitivity to different populations, but they did not show sensitivity to verify the improvements after training. However, individuals can vary task intensity throughout the performance-based test. In this context, older adults may adjust speed of the task in order to have lower energy expenditure and to maintain and acceptable level of perceived exertion (HOVINGTON; NADEAU; LEROUX, 2009). Moreover, older adults need to achieve their best score in the performance-based tests during a short period of time. Thus, the older adults stimulus to perform their best may influence on tests result. It may explain the reasons of the test results conflicting on the previous studies, considering the training improvements (CADORE et al., 2014; LOPES et al., 2016; NELSON et al., 2007). These arguments are considered performance-based tests limitations. Furthermore, a different approach is needed to differentiate dependence in performing self-care activities after a period of training in order to supply the limitation of the performance-based tests.

A test is necessary to be developed to differentiate the level of dependence in performing self-care activites, providing a valuable tool to older adults healthcare professionals. Hence, the present study proposes that perceived exertion with a constant-load test may be an alternative approach to differentiate dependence in basic and instrumental daily living activities. The rating of perceived exertion (RPE) is highly correlated with heart rate and oxygen uptake responses to a load-incremental exercise protocol, where each of the above factors is standardized (BORG, 1998; RYNDERS et al., 2011). These physiological measures are used as criterion

variables, since the increase of the physiological measures and the RPE are directly proportional to the exercise intensity, as they have been shown previously (CHUNG et al., 2015; COLBERG; SWAIN; VINIK, 2003; REYCHLER et al., 2015). The 6-20 Borg scale has presented correlation with limited physical function, greater disability, greater fear of falling, and less confidence in walking in older adults (JULIUS et al., 2012). The physical fitness level can influence RPE (JULIUS et al., 2012) and may be used to distinguish the level of functional capacity in older adults. The daily life performance depends on physical capacities, such as strength, power, balance, flexibility and others (FAYAD et al., 2008). Therefore, older adults with high level of physical fitness can perform the exercise reporting lower RPE than the ones with lower physical fitness.

Indeed, Souza and colleagues had already used the RPE in constant-load tests to differentiate dependence in performing activities of daily living in older women (SOUZA et al., 2018). The constant-load tests were performed using arm-curling and walking test in a treadmill to avoid exercise intensity adjustments during the test and to reduce motivational influence on the results. The older adults who were independent in daily living activities reported less tiredness (i.e., lower RPE) than those individuals who presented some dependence in such activities. Thus, the concurrent validity and reliability of the RPE in constant-load tests were confirmed to quantify the dependence level in performing daily living activities in older women. On the other hand, they did not analyse the sensitivity of the instrument, which is the capacity of the instrument to differentiate older adults after a period of training. There is a lack of tests that can verify the improvements after training. Thus, the importance of developing new tools to have an analysis of the older adults after a period of training. Another point is that the majority of older adults neither are familiar nor have

access to the treadmill, making the test less safe and confident. Once, it is hard to take the treadmill to some places, the test becomes very limited to be evaluated with a large number of older adults. In addition, it may not properly reflect overground walking in older adults (KANG; DINGWELL, 2008). It can artificially reduce the natural variability and local instability of walking by control the speed of it (BRACH; VANSWEARINGEN, 2013). The small number of older women, the non-inclusion of the older men and the non-randomization have been considered limitations of Souza and collegue's study (2018) too. Considering these arguments, it may be assumed that it is crucial to develop a test that mimic the daily living activities with a large number of older adults and verify if this test can be sensistivitiy to a period of training.

To overcome the limitations, perceived exertion in constant-load test in activities that simulates the daily living with a randomization large number of older adults (men and women) must be developed in order to differentiate dependence in performing self-care activities. A test that can simulate the daily living activities, is easy to take to places and can be sensitivity to the training period, is necessary to be validated. The sit to stand test may be used to predicted the dependence level in performing self care activities. It is possible to take this test to everywhere and evaluate a large number of older adults, once it requires just a chair. The test that simulates the daily living activities has been more effective to differentiate dependence level on it (RIKLI; JONES, 1999). Having as its goal to evaluate the dependence level, it is required a specific test to evalute precisely the performing of daily living activities.

Therefore, when a test is developed it is crucial to verify its validity and reliability, in order to show the results accuracy and the applicability in a specific population (STREINER; NORMAN; CAIRNEY, 2015). The other factor that is relevant in the validity of perceived exertion test is the diagnostic accuracy, which is

the ability of a test to discriminate property and to predict the disease and health conditions (ŠIMUNDIĆ, 2008). It is important to verify the validity, reliability and diagnostic accuracy factors of the test when specific individuals have been studied.

The sensitivity is also important to verify the capacity of the test to differentiate the changes in time and in different individuals. To verify it is necessary to differenciate trained and untrained older adults and their dependence level in performing self-care activities. Currently, the training effects have been evaluated throught performance-based tests in older adults. There are many studies that evaluate pre and post-training with the performance-based tests battery (LOPES et al., 2014; MISIC et al., 2009). Some studies showed significant improvements after training (CADORE et al., 2013) while others did not (IZQUIERDO; CADORE, 2014). The performance-based tests were not specifically developed to evaluate training improvement, as they depend on the older adults stimulus, which may be different in the pre and post training instants. It may explain the difficulties to detect training effects on functional capacity (KING et al., 2000). Therefore, the sensitivity of the RPE in constant-load tests must be verified in order to analyse the improvements in dependence level in performing self-care activities after training. It is important to verify the improvements in dependence level in performing self-care activities in older adults that presented some limitation, such as the older adults that live in institutionalized places. The institutionalization can be a negative factor for disability since it encourages sedentary habits and lack of exercise, which older adults Considering that the RPE in constant-load tests has the same intensity pre and pos training, it is easier to determine the training effects between the two instants.

In order to differentiate the dependence level in performing activities of daily living in older adults, the validity of the perceived exertion in constant-load test has

been necessary. In addition, verifying the validity, reliability and sensitivity of the RPE in constant-load tests can be considered another tool to assess accurately the ability of older adults to perform independently self-care activities, giving another tool to differentiate the dependence level in performing activites of daily living. The aim of this study was to verify concurrent validity, reliability and sensitivity of the perceived exertion in constant-load tests to differentiate dependence in performing activities of daily living in older adults.

CHAPTER 2

GOALS AND OUTLINE

2 Goals and outline of the thesis

The aim of this study was to verify concurrent validity, reliability and sensitivity of the perceived exertion in constant-load tests to differentiate dependence in performing activities of daily living in older adults. This study focused on the following research hypotheses:

1. The perceived exertion in constant-load tests presents concurrent validity and reliability to differentiate the dependence level in daily living activities in older adults.
2. The perceived exertion in constant-load tests presents sensitivity after a period of multicomponent training program in institutionalized older adults.

To verify these hypotheses, two experimental studies were done. In these studies, the modification of two performance-based tests to a constant load (sit to stand and arm curling test) were used first to determine whether the tests can differentiate dependence in performing activities of daily living in older adults, and second to verify whether the institutionalized older adults present a different perceived exertion in constant load tests after a period of multicomponent training program. The idea was to investigate if the older adults that present more dependence in performing activities of daily living would report higher perceived exertion responses.

Chapter 3 reported the literature review of the study, considering the principal topics to understand the goal and outlines of the present thesis. A review chapter of the literature on the main aspects covered in the 2 studies that related to the thesis proposed.

Chapter 4 reported the data about the ability of perceived exertion in constant-load tests to differentiate dependence in performing activities of daily living in older adults. In this chapter it has been analyzed the concurrent validity of the perceived exertion responses in constant-load tests to differentiate dependence in activities of daily living obtained from questionnaires. The similar responses during three days of the perceived exertion in constant-load tests have been analyzed in this study to check the reliability. The results are related with the validity and reliability of perceived exertion in constant-load tests.

Chapter 5 reported the data about the sensitivity of perceived exertion in constant-load tests to differentiate the dependence in performing self-care activities improvements after a period of multicomponent training. The analyses were to determine if the older adults who participated in the multicomponent training reported a lower response of perceived exertion in constant-load tests than control group. In these analyses, it can be determined the ability of the perceived exertion to be sensitive to physical training in order to differentiate PRE from POST values.

In the Chapter 6, the findings of the chapters 4 and 5 are described to discuss the concurrent validity, reliability and sensitivity of the perceived exertion in the sit to

stand and arm curling tests performed with constant-load in association with the outcomes of the studies. General conclusions and recommendations for future studies are also provided.

CHAPTER 3

LITERATURE REVIEW

3.1 Literature Review

In order to substantiate and provide theoretical support to the research problem this chapter will contemplate some contents of the literature, which will be organized in two topics. The first one refers to the disability process and the instruments that evaluate dependence measurements in performing self-care activities in older adults. The second one refers to the perceived exertion as a way to differentiate dependence in performing activities of daily living in older adults. This review will be effective to understand the instrument process of validation (validity, reliability, and sensitivity), and also to get knowledge to develop a new tool to differentiate the dependence in performing activities of daily living in older adults.

3.2 Measuring dependence in performing self-care activities

According to the World Health Organization (WHO, 2001) more than 1 billion people (approximately 15% of the world's population) live with a form of dependency (disability). The population that lives with significant difficulties in functional capacity represents 2% to 4% of the older adults (WHO, 2001). The prevalence of functional capacity changes according to the age group, 8.9% in 15-49, 20.6% in 50-59 and 38.1% in 60+ years-old (WHO, 2001). The dependence in performing self-care activities have been becoming increasingly important due to their negative consequences in self-esteem, high health costs and quality of life (TOPINKOVÁ, 2008), being a predictor of mortality in older adults (OSTIR et al., 1998).

Disability is defined as the dependence in carrying on the essential activities to independent living, including essential roles and tasks needed for self-care, as well as leisure activities, which are important to one's quality of life (NAGI, 1976). Disability refers to difficult in performing the activities that can affect the people's social life causing the limitation in tasks (NAGI, 1965). The process of disability was built by Verbrugge et al. (1994) and was called "The Disablement Process" (VERBRUGGE; JETTE, 1994). This process describes how chronic and acute conditions affect the activities performance in specific body systems. Generic physical and mental actions and activities of daily life describe the personal and environmental factors that can cause either accelerate or delay in the disablement process, risk factors, interventions and exacerbators (NAGI, 1976). The Verbrugge's process had been focused in pathology, impairments, functional limitations and disability. In the real life, the main pathway does not occur in the same sequency of the literature, it happens associated with social, psychological behavior, environment factors (etc.) which infer in the disability process (VERBRUGGE; JETTE, 1994). The functional disability model is shown in Figure 3.1.

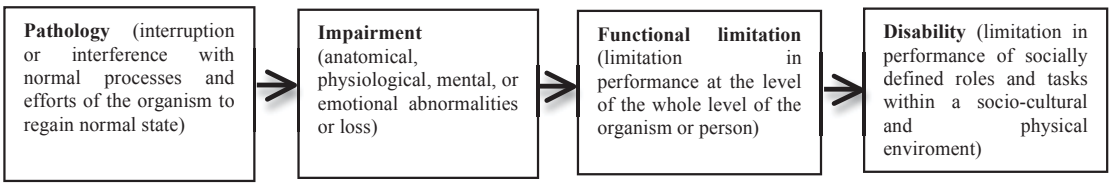

Figure 3.1 Adapted definition of the functional disability model by Nagi (1965).

The pathology is a referential as biochemical and physiological abnormalities, which are detected as a disease, injury or congenital conditions (YANG; DING; DONG, 2014). Pathologies have been considered chronic and progressive diseases, lesions with long-term squealed, enduring structural/sensorial abnormalities and acute pathology, being short-term diseases and injuries with the duration of >3

months (VERBRUGGE; JETTE, 1994). The pathology detection has been done through the evaluation of the signs and symptoms that have been showing with more frequency (also called damage and weakening). As pathologies lead to functional consequences for older adults, these are called impairment or weaknesses that are reported through the Nagi model (1976) (NAGI, 1976). Impairment is characterized as significant structural abnormalities in the body's specific systems (RIKLI; JONES, 1999). Abnormalities in skeletal and muscular structures have consequences in the physical, mental or social functioning (WHO, 2001). The impairment can be evaluated throughout clinical examination, laboratory and functional tests. Physical inactivity has either an independent or direct effect on physical impairment and functional decline, due to the considerable physical atrophy that have been presented in studies that focus in inactivity behavior (RIKLI; JONES, 1999) (Figure 3.2). Some studies demonstrated that the physical inactivity is related to chronic diseases as a determinant of functional decline (STARKOFF et al., 2016). These studies also showed that physical activity participation is associated with higher levels of mobility, even for older adults who have already had chronic conditions.

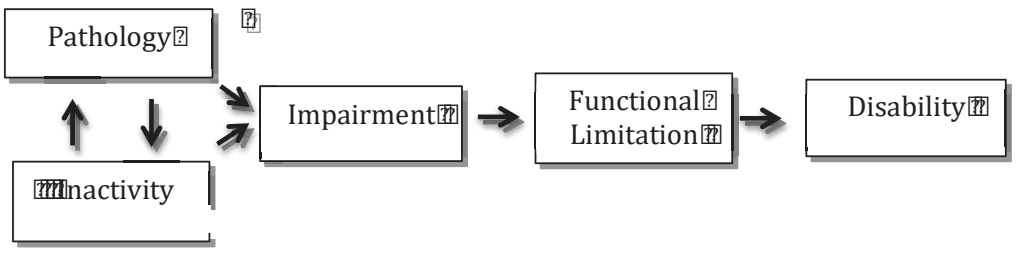

Figure 3.1 Adapted scheme from the Rikli and Jones (1999).

The functional limitations are restrictions in performing fundamental physical and mental actions used in daily life by one's age group (RIKLI; JONES, 1999; VERBRUGGE; JETTE, 1994). The functional capacity of an individual, in a specific domain, is a complex relationship between health condition and contextual factors (e.g., environmental and personal factors) (WHO, 2001). These generic actions indicate general body and mind abilities to perform a specific task. Physical actions are classified as general mobility, discrete movements and forces, problems with vision, hearing and communication. An example of these physical actions is the difficulty of the person to raise objects and read in the file pattern print (LECHNER, 2002). The functional limitations are considered restrictions in physical behaviors such as rising from a chair, lifting or climbing stairs (RIKLI; JONES, 1999). These activities can be evaluated through self-reports questionnaires and interview observation of the subject doing action (e.g. berg balance test) (HOEYMANS et al., 1997). The functional limitations lead to disability that is considered the inability to perform normal daily activities such as bathing oneself, housework, or shopping.

Disability results in the interaction of the pathology, impairment, functional limitation and their relation with the environmental challenges faced by a person (GURALNIK; FERRUCCI, 2003). The definition of disability contains two important and novel features: first, chronic conditions that can affect any activity domain, from hygiene to hobbies, from errands to sleep, involving the personal care (basic activities of daily living, ADL); household management (instrumental activities of daily living, IADL) and job (paid employment). The ADL are abilities to eat, toilet, transfer and bathe among others. The IADL are abilities to prepare own meals, do light housework chores, manage money, and use telephone among others. Job is considered the ability to house and yard chores, shopping, working, sleeping,

childcare, hobbies and other leisure actions. Second, the feature of disability is considerated the difficulty of doing activities in one's regular place (VERBRUGGE; JETTE, 1994). Disability is measured in simple and direct manner by self-reports or proxy-reports about degree of difficulty (none, some, a lot, unable) (TOPINKOVÁ, 2008). Thus, the dependence in activities of daily living is considered the consequence of the relation between pathology, impairments and functional limitation.

Functional capacity is defined as the efficiency of the older adults in responding to the physical demands of the daily life, which includes basic activities to more complex actions (VERBRUGGE; JETTE, 1994), related to performing with independence in basic and instrumental tasks of daily life (ETSUKO DA COSTA ROSA, TEREZA, D'AQUINO BENÍCIO; DIAS DE OLIVEIRA LATORRE; RAMOS, 2003; GARBER et al., 2011). Autonomy in basic and instrumental activities of daily living is a fundamental part of the human being. Once this autonomy is deteriorated, actions in the physical, social and psychological spheres are negatively affected (SANTOS; VIRTUOSO JÚNIOR, 2008). Functional capacity dependence risk factors are considered: increased age, female sex, low illiteracy, disease burden, depression, impaired vision and cognition, low physical activity, functional limitations of smoking, low self-perceived health and low frequency of social contacts (ROSA et al., 2003). The functional capacity can be assessed through the performance-based tests and predicted through the self-reported questionnaires (TOPINKOVÁ, 2008).

Self-reported questionnaires were validated to evaluate dependence in performing basic and instrumental activities of daily living in older adults. Lawton questionnaire is an example of evaluating dependence, thus it focuses in the measurement of instrumented independent living skills (GRAF, 2008). This skills

require greater development of the cognitive part, greater ease in social relations and ability to deal with adversity, which are influenced by the degree of schooling (SIKKES et al., 2009). The questionnaire covers some questions about the older adults ability to perform some activities such as, call, pay bills, travel, prepare meals among others. The older adults that cannot do the activities receive a small score and are diagnostic with total or parcial dependence. Currently, the Katz questionnaire is an example of evaluating dependence in performing basic activities of daily living (KATZ; STROUD., 1989). The Katz questionnaire finds evidence of physiological mechanisms related to functional capacity, tending to validate the index as a true measure of primary biological and psychosocial function (YANG; DING; DONG, 2014). The instrument covers some activities such as bathing, eating, urinary incontinence among others. Therefore, the older adults that cannot do the activities are classified as dependent or partially dependent, and the ones that do all the activities independent. Despite the limitation of the questionnaires such as the memory and the true responses of the older adults, they are considered a standardize and the most used evaluation to quantify the dependence in performing activites of daily living in older adults.

The battery of performance-based tests assesses the physiologic parameters that support physical mobility in older adults (GURALNIK et al., 1995; RIKLI; JONES, 1999). The battery is a set of 7 tests that simulates the daily living activities, such as sit to stand, walking, arm curling, flexibility of the lower limbs, among others. These tests evaluate the muscle endurance and strength, aerobic endurance, flexibility, static and dynamic balance and body composition (RIKLI; JONES, 1999). The evaluation of more than one physical ability (strength, balance, aerobic endurance) has been considered very important to obtain an overview of the older adults physical

condition (RIKLI; JONES, 2013). Some performance-based test batteries have been elaborated in order to take into account the different physical abilities in older adults (GURALNIK et al., 1995; RIKLI; JONES, 1999). Physical fitness components influence the individual's ability to overcome a specific barrier. The older adults that have a higher physical activity level present better responses in the performance-based tests (GURALNIK; FERRUCCI, 2003).

Moreover, the performance-based tests have some limitations, such as varied intensity throughout the tests performance and the motivation of the older adults to perform their best score (as fast as possible) in a short period of time. The older adults may adjust the performance-based test speed in order to expend less energy expenditure and to fell an tolerable sensation of perceived exertion (HOVINGTON; NADEAU; LEROUX, 2009). The other negative characteristic of this test is the older adults necessity to perform their best during the tests to assess their level of functional capacity. The older adults need to be motivated to do it, otherwise the tests will not be assessing accurately the physical capacities (SOUZA et al., 2018). The performance-based test have two disadvantages: self-selected speed and the need of motivation. Functional performance tests may not be the best way to assess the dependence in performing activites of daily living in older adults, even though the instruments had already been validated for this function (DUARTE; DE ANDRADE; LEBRÃO, 2007; RIKLI; JONES, 1999).

Therefore, a test that can evaluate the dependence in performing self-care activities is necessary to be developed. Furthermore, before developing the test is necessary verify the validity and reliability. Validity has been defined as the accuracy and/or appropriateness of the interpretations given by test scores and uses made of it (STREINER; NORMAN; CAIRNEY, 2015). The concurrent validity has been tested

in a correlation between the previously proven measures that have already been validated and the new tool (PASQUALI, 2009). In addition, test reliability is characterized by the accuracy, confiability, the characteristic that it must possess, knowing and measures without mistakes (PASQUALI, 2009). Measures without mistakes mean that the same protocol will produce similar results in different days with the same subjects. The test reliability is crucial for the validity process; the instrument needs to be constant in the results. Determining the diagnostic accuracy of a test is also important. The diagnostic accuracy is related to the capacity of a test to have discriminative property and predictive ability (ŠIMUNDIĆ, 2008). The diagnostic can be established using a research protocol that examines the agreement between a conditional test that has already been validated and a reference (criterion) test. These factors show the accuracy and precision of the results and the applicability in the population. Validity, reliability and diagnostic accuracy have been considered essencial for the application of a new developed test to differentiate dependence in performing activities of daily living and confirm what the test really measures.

As life expectancy continues to increase, the number of years people spend living with disabilities, that compromise quality of their lives, has been increasing the necessity to prevent or delay the disability and to promote health lifestyles as well (LEVEILLE; RESNICK; BALFOUR, 2000). Few standardized suitable tests have been developed in order to assess physical performance in the large population. All assessment items should have an acceptable test-retest reliability, appropriately validity and enough discrimination diagnostic to assess the population that will be studied. Additional tests are needed to be developed that adequately assess dependence in performing self-care activities in older adults. Therefore, the new test

needs to have validity and reliability confirmed, considering the same speed for all older adults in order to control intensity and consequently decrease the influence of motivation on results.

3.3 Perceived exertion in constant-load tests used to differentiate dependence in perfoming self-care activities

Rating of perceived exertion (RPE) is defined as the “conscious sensation of how hard, heavy, and strenuous a physical task is” (MARCORA, 2010). It is used in the areas of sports and rehabilitation, and its application involves monitoring and prescription of exercise intensity (NOBLE; ROBERTSON., 1996). The Borg 6-20 scale was elaborated to corrrelate the heart rate, anaerobic threshold, physiological marker and metabolic zones transitions in order to facilitate its use (BORG, 1982). Deruelle et al. (2007) reported that RPE 6-20 scale could be used to detect respiratory compensation point intensity, whereas RPE between 12-13 may coincide with the anaerobic threshold in the exercise test with trained older adults (DERUELLE et al., 2007). The linear correlation between the physiological variables helps RPE to predict the training load (BORRESEN; LAMBERT, 2009), as well as to demarcate the exercise intensity and duration (NOAKES, 2000). A higher RPE is typically associated with the increase of physiological stress and fatigue. Thus, some physiological perturbations, such as an increase in heart rate, ventilation and metabolic acidosis also result in a higher RPE.

The RPE has also been correlated to the energy expenditure in older adults with chronic kidney disease (MACDONALD et al., 2012). The older adult who

presented lower physical fitness in daily life activities had a greater perceived exertion (MACDONALD et al., 2012). These results indicate that perceived exertion may be influenced by the level of physical fitness, and possibly be used to distinguish the level of functional capacity of older adults (MACDONALD et al., 2012). Perceived exertion can be a tool to regulate the test intensity and to differentiate individuals with some pathology from those healthy ones. JULIUS et al., (2012) identified that older adults with mobility limitations perceived some kind of effort had correlated with physical function, fear of falling, and less walking confidence (JULIUS et al., 2012). The older adults that reported more than 6 RPE in walking had more limited physical function, greater disability and fear of falling, and less confidence than those who reported no effort during walking. PIERCE et al., (1993) presented a lower RPE in the trained young groups compared to the untrained ones, which indicates that healthier individuals report lower RPE than sedentary ones (DEMELLO et al., 1987; PIERCE K., ROZENEK R., 1993). The reduction in RPE can also be verified in sedentary older compared to young adults, when both older and younger adults exercised at the same intensity, older adults reported significantly greater overall perceived exertion during cycling than younger group (DOHERTY et al., 2001; FOCHT et al., 2007). The perceived exertion can be more related to physical abilities and health than just with age. However, it may be suggested that perceived exertion could be an alternative to differentiate dependence in performing self-care activities after a period of training in older adults.

The perceived exertion has been used as a tool to differentiate dependence in performing self-care activites (SOUZA et al., 2018). Two constant load tests have been done using the perceived exertion in older women, the arm curling and the walking in a treadmill test. The constant-load test was selected to maintain the same

load for all older women in order to control the intensity and the influence of motivation in test performance. The authors found that older women with dependence in performing self-care activities reported higher RPE than the independent ones (SOUZA et al., 2018). Therefore, it has been concluded that RPE in constant-load tests could differentiate dependence in performing self-care activities in older women (SOUZA et al., 2018). However, the test was performed in a treadmill. Thus, it is not a good test to evaluate older adults, once the majority of older adults have never used the treadmill before and it is not related to activities of daily living. It can artificially reduce the similarity of the overground walking and local instability of walking (KANG; DINGWELL, 2008). The treadmill is not easy to evaluate in everywhere, because it is difficult to take it to places, making the test very limited to evaluate a large number of older adults. A representative number of older women are also important to verify the validity and reliability of a new test as well as include the older men in the study. Therefore, the randomization is necessary to calculate the representative number of older adults and to control the participant's selection (ROSENBERG et al., 2010). All these tools have been essential to replicate the instrument for all population. The small number of older women, the participant's non-randomization and the treadmill test were considered limitations of the Souza et al., (2018) study. However, investigating the perceived exertion in constant-load tests that simulates the activities of daily living with a greater number of older adults (men and women) is necessary.

The rationale for using a test that simulates the activities of daily living is based on the facilities of doing an activity that older adults are accostumated to perform. On the other hand, the need of the test specificity, to evaluate precisely the goal which is to differentiate dependence in performing activities of daily living, is

better when we consider the daily living task. The other important point is the constant-load test that can control the speed and intensity variation in order to control the influence of motivation into the results and the different physical capacity of older adults. The validity and reliability of the instrument need to be verified before apply for the entire population. Furthermore, it was found on the literature a lack of instruments that can differentiate dependence in performing activities of daily living in older adults and can verify the dependence improvements after a period of training (GURALNIK; FERRUCCI, 2003). The sensitivity of the instrument is related to its capacity to detect the changes after a period of training in older adults (CURRELL, K; JEUKENDRUP, A, 2008).

There are many studies that evaluate pre and post-training with the performance-based test battery (CADORE et al., 2013; LOPES et al., 2016; MISIC et al., 2009). Some studies found improvements in performance-based tests after training (CADORE et al., 2013; LOPES et al., 2014) while others did not present improvements (IZQUIERDO; CADORE, 2014; LOPES et al., 2016). The main objective of performance-based tests was the development of reliable and valid tools that can measure performance on a continuous scale through functional skills tests (RIKLI; JONES, 1999). Thus, it may not be specific to evaluate the training improvement, once they depend on older adults motivation, which may be different in pre and post training instants. The older adults that performed the training program might have higher motivation than control group (MEURER et al., 2012). They can choose their performance in the test speed, considering intensity variability in these tests which is not the same in pre and pos training instants. Therefore, it is shown the importance of creating a test that can evaluate the improvements in dependence in performing activites of daily living after training in older adults. Thus, using wrong

instruments gets difficult to find improvements, not due to the effectiveness of the training but the use of such instruments. Finally, it is necessary to verify the sensitivity of perceived exertion in constant-load tests to differentiate dependence in performing self-care activities in older adults after a training program.

CHAPTER 4

Concurrent Validity and Reliability of the Perceived exertion in a constant-load test in older adults

4.1 Introduction

It has been estimated that more than 1 billion people (~15% of the world's population) live with some kind of dependency. In addition, from 2% to 4% of the population has significant difficulties in functional capacity and presents some disability (WHO, 2001). Disability is characterized as the outcome or result of a complex relationship between an individual's health condition, personal factors and external factors circumstances in which the individual lives (WHO, 2001), in other words the disability is the amount of difficulty or inability to perform basic self-care activities, referred to as activities of daily living, such as bathing, dressing and eating (KATZ et al., 1963). However, functional capacity is characterized by older adults efficiency in responding to physical demands of the daily life (DEL DUCA; SILVA; HALLAL, 2009; VERBRUGGE; JETTE, 1994). The decrease of disability and functional capacity has negative consequences in the self-steem, high health costs and quality of life in older adults and have been becoming increasingly important due to be a preditor of mortality in older adults (OSTIR et al., 1998; TOPINKOVÁ, 2008). The early diagnostic of physical and functional decline in older adults improves healthcare outcomes and health promotion recommendations that will be provided to older adults (BRACH et al., 2002).

The diagnostic of the dependence in perfoming activities of daily living in older adults has been considered essencial to detect the older adults that need assistance. The dependence in performing activities of daily living could be predicted through the performance-based tests (GURALNIK et al., 1995). The performance-based tests are considered physical measurements, which are objective tests of standardized task performance. When the older adults perform these functional tasks they are

encouraged to do it in order to reach their best score, being classified according to a predertemined criteria. Moreover, older adults may adjust the test velocity to have lower levels of energy expenditure and to maintain an affordable amount of perceived exertion (HOVINGTON; NADEAU; LEROUX, 2009). Furthermore, to achieve their best effort in the score in a short period of time they need to be stimulated to perform their maximum in the test (DUARTE; DE ANDRADE; LEBRÃO, 2007). This is considered a negative characteristic of performance-based tests, once some aspects influence the older adults to do or not to do their maximum performance, and during the tests their wishes can be changed. Higher levels of physical fitness have been directly related to the effectiveness of daily life activities and to performance-based test (FAYAD et al., 2008). In this way, the older adults with greater level of physical fitness will feel less fatigue in performing the tests. In order to differentiate dependence in performing self-care activities another test with the same intensity may be done.

The rating of perceived exertion (RPE) could be a tool to measure the dependence in performing self-care activities (BORG, 1974). The RPE provides a global quantification of an individual's effort and fatigue, taking into account physiological, psychological and performance factors (SCHERR et al., 2013). The Borg 6-20 RPE scale has been correlated with several physiological measures of performance effort, including oxygen volume and heart rate during exercise (DOHERTY et al., 2001; DUNBAR C. C., ROBERTSON R. J., BAUN R., BLANDIN M. F., METZ K., BURDETT M., 1992; NOBLE, BRUCE J., BORG G. A. V., JCOSBS I., CECI R., 1983) and also with limited physical function, greater disability, fear of falling and less confidence during older adult walking (JULIUS et al., 2012). Recently, the RPE in constant-load test was used to differenciated older adults that had a good

physical fitness level, due to the feeling of less perceived exertion in this test. The older women performed the RPE in constant-load walking and arm-curling tests and the results were correlated with the questionnaires that evaluate the dependence level in performing self-care activities (SOUZA et al., 2018). Considering this correlation, it was concluded that the RPE in constant-load walking and arm-curling tests could be a way to differentiate the dependence level in performing daily living activities in older women. However, more studies have been required to conducte RPE in constant-load test, in order to supply the limitations of Souza's study (2018), such as the randomization selection, the treadmill test and a larger number of older adults (women and men) and to confirm the capacity to differentiate dependence level in performing self-care activities in older adults.

The level of physical fitness may influence the perceived exertion responses due to it can be used to distinguish the functional capacity level of older adults. According to Groslamber et al. (2006), the RPE responses are more affected by physical fitness and health status than by the aging itself (GROSLAMBERT; MAHON, 2006). The older adults first perceive an increase in exertion during self-care activities what questtionaires have assessed decline in working capacity over time (frequently asked in questionnaires). However, the older adults with dysfunction expend greater effort on daily tasks, being more likely to perceived greater RPE than the health ones. The motivation in the evaluation of dependence in performing self-care activities can be controlled with a constant-load test that used the perceived exertion to measure the intensity and a task that is similar to everyday live. The concurrent validity, reliability and diagnostic accuracy are determinant to be evaluated before using the new test, once these factors shows the accuracy results, confirming what the test intends to measure and the applicability in a specific

population. Thus, it is essencial to verify the concurrent validity, reliability and the diagnostic accuracy of the RPE in constant-load test.

The RPE in constant-load test can be crucial to give a better assessment to differentiate dependence in performing self-care activities in older adults. The aim of this study was to verify the ability of perceived exertion in constant-load tests to differentiate dependence in performing activities of daily living in older adults. A greater perceived exertion has been expected to be associated with dependence in performing self-care activities in older adults.

4.2 Methods

The experimental was considered a transveral study. The study protocol was approved by the University Research Ethics Committee, and the older adults that participated in the study received an informed consent (CAAE: 48548715.5.3001.01/01) (APPENDIX I and APPENDIX II). The study had a partnership with “Secretaria Municipal de Saúde”, in order to collect the data and invite the older adults who attend the Basic Health Units (BHU) and the institutionalized homes (Nursery) of Curitiba city, Brazil. Older adults with the consent of the Basic Health Units workers were invited to participate in the study. The inclusion criteria were: a) 60 years or older of both sexes; b) able to walk with or without assistance of devices (e.g. cane, walker). The exclusion criteria had been diseases in the older adults that made impossible to perform functional tests, either understood questionnaires or guidelines (e.g. cognitive impairment, neurological, musculoskeletal and decompensated heart, among others).

According to the “Secretaria Municipal de Saúde” (SMS) report of 2014, the population for this study was composed of 100,194 older adults, subdivided in the respective 9 districts of Curitiba. The Basics Health Units are distributed by the municipality according to nine districts of Curitiba (Neighborhood) (Bairro Novo, Boqueirão, Boa Vista, Cajuru, Matriz, Pinheirinho, Portão, Santa Felicidade and CIC). Considering all these districts, Curitiba has 65 Basic Health Units that attend the Family Health Program and 42 traditional Basic Health Units that attend everyone. The Epiinfo calculator was used for the Disease Control and Prevention (CDC) and considered the following Statistical parameters living by the “Secretaria Municipal da Saúde”: (i) Curitiba population of 100,194 older adults; (ii) the level of interval of confidence 95%; (iii) anticipated frequency 50%; and (v) Sample Correction (deff) of 1.0 (confidence limits 8%). Thus, the necessary sample size value was 150 older adults.

A hundred and sixty-one older adults (123 women and 38 men) attended to the initial invitation, completed 3 days of testing and participated in the entire study. The participants were evaluated in 3 testing sessions, 2-9 days apart (Figure 4.1). In the first session the participants performed weight, height and Body Mass Index (BMI) calculator in order to characterized the older adults. The performance-based tests (time and go test (tug), sit to stand, arm curl, chair sit and reach, back scratch), 4 meters walk, Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) questionnaires were evaluated to check the concurrent validity of RPE measure in constant-load tests. In addition, a familiarization with the Borg 6-20 RPE in constant-load sit to stand and arm-curling tests was performed reporting perceived exertion at the end. On the second and third day, the participants performed the RPE

in constant-load arm-curl and sit to stand tests, to check the reliability of the RPE measure in the modified constant-load tests.

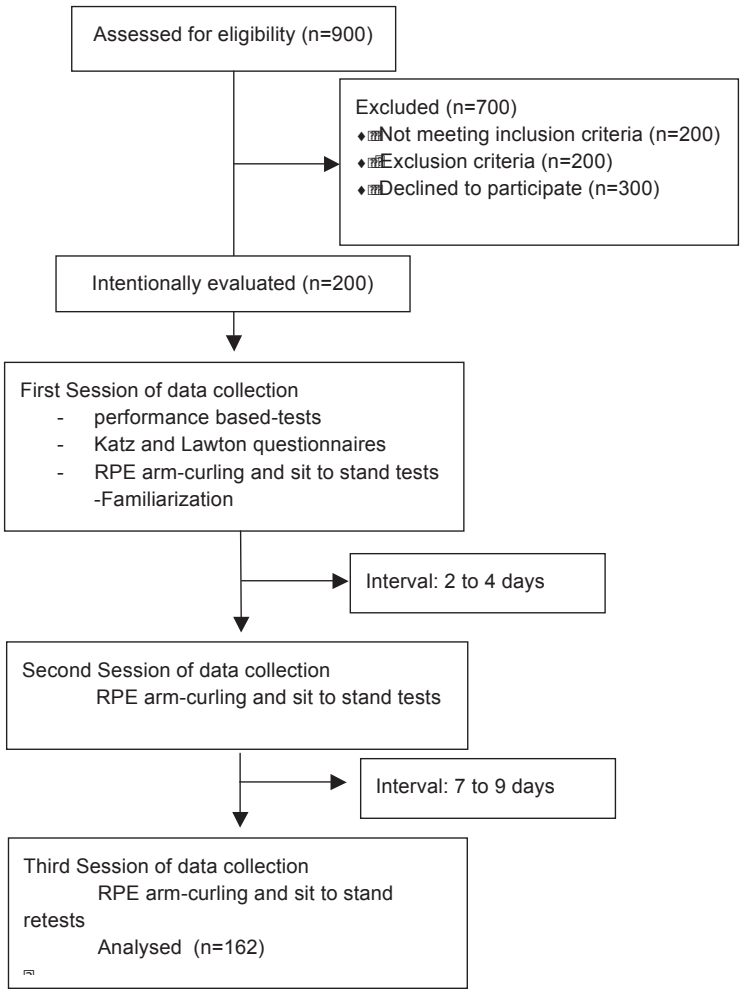

Figure 4.1 Experimental design from the days of data collection.

Performance-based tests

The performance-based tests was evaluated through tests according and adapted by Rikli and Jones (1999) (CHUNG et al., 2015; MANORANGSAN; PANPEACH; VORAKITTIKUL, 2004; PODSIADLO; RICHARDSON, 1991; RIKLI; JONES, 1999). Which consists of five tests including flexibility of arms and legs (chair sit and reach test and back scratch), lower body strength (5 repetitions as fast as possible of siting to standing test), upper body strength (maximum repetitions of arm

curling during 30 seconds, 2 kg for women and 3kg for men) and dynamic balance (time up and go test, stand up of a chair and walk a distance of 3 meters and sit). The tests were performed in a randomized order with a rest period of 2 minutes. These tests were detailed described (MANORANGSAN; PANPEACH; VORAKITTIKUL, 2004; PODSIADLO; RICHARDSON, 1991; RIKLI; JONES, 1999; SPOSITO et al., 2013).

Four meters walk

The four meters walk test was used to estimate walking speed (GRAHAM et al., 2008; ROGERS et al., 2003), in which the distance was 8 meters demarcated on the floor with tape in four positions: ground zero meter, 2 meters, 6 meters and 8 meters. The older adult was positioned on the Zero point and after the verbal command "go" the participant walked by a distance of 8 meters straight. The tests were held 3 times and the first two meters and the last meters are deleted to allow the acceleration and deceleration (ROGERS et al., 2003). The distance of 4 meters were divided by the time taken to complete the route providing the measurement of Gait velocity (m/s) (Figure 4.2). The older adults were asked to walk in their normal step and any encouragement had been given to the participants in order not to influence the results (GRAHAM et al., 2008; ROGERS et al., 2003). The participant that walked below 1m/s in the course of 4 meters was considered insufficitent and the participant that walk > 1m / s was considered adequate speed, i.e. without falling risk (STUDENSKI; PERERA; PATEL, 2011).

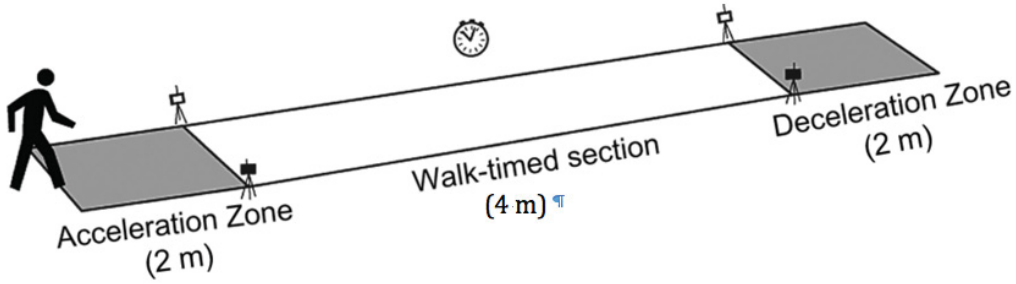

Figure 4.2. The representation of the 4-meter walking test.

Perceived exertion during constant-load physical tasks

Perceived exertion has been defined as the conscious sensation of how hard, heavy, and strenuous a physical task is (MARCORA, 2010). Therefore, in this study the RPE was used in a constant-load task simulating daily living activities. Before each session day, the participant received instructions about using the Borg 6-20 RPE scale (APPENDIX III), as previously reported in a BORG 1982 Portuguese translated book of (BORG, 1982; BORG, 2000). The first day of data collection was done a familiarization session of the perceived exertion in constant-load tests, in order to older adults understanding the RPE instructions and the constant-load test. The perceived exertion depends on how difficult is to exercise with the legs or arms, how difficult is to breathe and overall feelings of tiredness for exercise. Participants were advised about the exercise duration and workload. The RPE scale was measured during two constant-load physical tasks. Pilot tests were performed before starting the data collection, to find the best time to control the speed in the tests. The 1st physical task was to sit and stand on a chair during 1 min, the intensity (velocity) was controlled signaled an electronic metronome that was programed for 4 seconds to stand and 4 seconds to sit (Figure 4.3). The intensity of the 4 seconds was chosen once the independent and dependent older adults could perform the test. The 2nd physical task was arm curling, participants were required to flex and extend both

elbows simultaneously while holding dumbbells (2kg for women and 3kg for men each side). The intensity was controlled by the electronic metronome, which was programed for 1 second to curl and 1 second to extend, 30 repetitions during one minute (Figure 4.4). The movement speed of the 1-second was chosen in order to control the velocity and to the independent and dependent older adults performance. Immediately after the physical tasks, participants reported their perceived exertion using Borg 6-20 category Scale (BORG, 1998) considering the exertion felt at the end of the task. Having the participant not to be able to accomplish the whole task due to exhaustion, there were given then a rating of 19 in the RPE scale. Between the constant-load physical tasks, participants either rested during 3 min in a chair.

The instructions were “During the exercise we want to assess your perceived exertion, that is, how difficult, heavy and arduous you feel the exercise. The perceived exertion depends on how difficult it is for you to exercise with your legs or arms, how difficult it is to breathe, and your overall feeling of tiredness for exercise. It does not depend on muscle pain, meaning the pain and burning sensation in your legs or arms muscles. Look at this scale; we want to use this scale from 6 to 20, where 6 mean “no effort, practically resting” and 20 means “maximum effort”. Nine corresponds to the “very light” exercise for a healthy person is considered similar to walking slowly at this own pace for a few minutes. Is a “slightly tiring” exercise, but it still feels good to continue. Seventeen on the scale “very tiring” is a very vigorous exercise. She really has to struggle. You feel very heavy and very tired. Nineteen on the scale is exhaustive exercise. For most this is the most intense exercise you have ever experienced. Try to evaluate your feellings of effort as honestly as possible without thinking about the workload (eg, heart rate, speed, power, intensity level of the exercise machine). Do not underestimate your perceived exertion. Look closely at

the scale and the expressions and then give a number. Any doubt?". (APPENDIX IV) The modified sit to stand and arm curling tests were explained to participants. Immediately after completing each of the physical tasks, participants were asked to report their RPE felt during the end of the task (BORG, 1998).

Figure Error! No text of specified style in document.**3** Representation of the RPE sit to stand in constant-load test. The Picture A shows the time that the older adults are standing and the picture B shows the time that older adults are seated. A metronome controls the standing and seated moment.

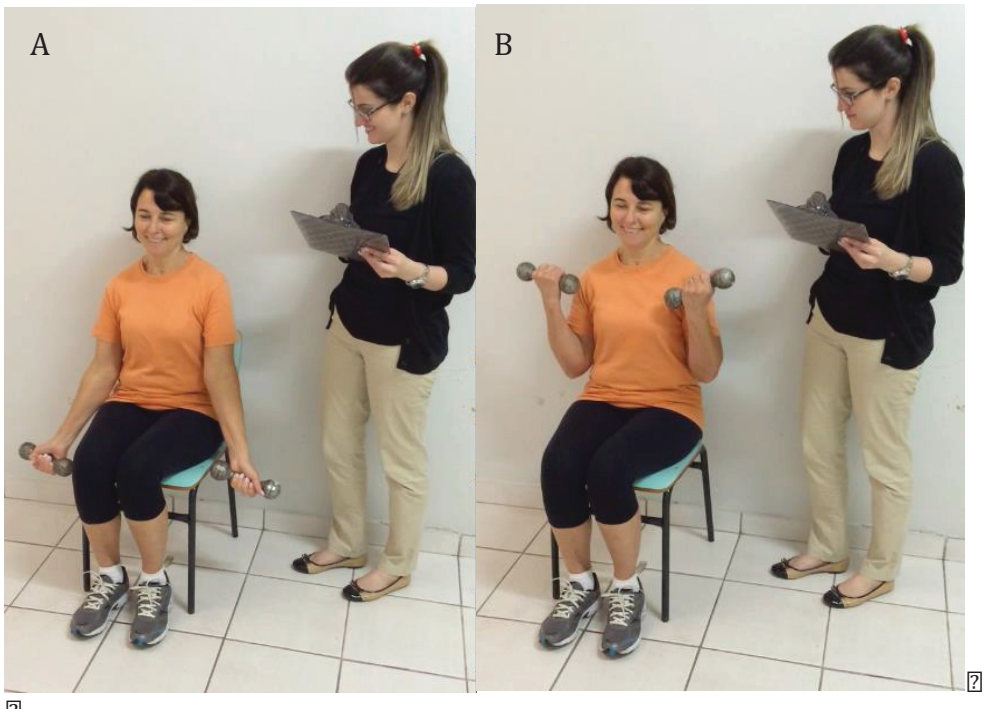

Figure 4.4 Representation of the RPE arm-curling in constant-load test. The picture B shows the time that the arms are flexed and the picture A shows the time that the arms are extended. A metronome controls the flexion and extension.

ADL and IADL self-report questionnaires

The cross-cultural adaptation of the Activities of Daily Living Index (Katz Index) was accomplished by translating the text from Katz and Stroud (1989) (KATZ; STROUD., 1989) to the Brazilian Portuguese language (DUARTE; DE ANDRADE; LEBRÃO, 2007). Based on self-report, participants answered when they needed help in performing any ADL (i.e., bathing, dressing, toileting, transferring, continence and feeding) (APPENDIX V). The results of this questionnaire were related to the degree of older adults disability: score 2 or less was considered very dependent (0), score 4 moderate dependent (1) and score 5 independent in one function and score 6 totally independent (2) (DUARTE; DE ANDRADE; LEBRÃO, 2007).

The cross-cultural adaptation of the Lawton Instrumental Activities of Daily Living Scale was accomplished by translating the text from Lawton and Brody (1969) (LAWTON; BRODY, 1969) to Brazilian Portuguese language (SANTOS; VIRTUOSO JÚNIOR, 2008). In this questionnaire, participants reported whether they were unable or able to perform any IADL (shopping, cooking, housekeeping, use of telephone, medication control, finances and transport) (APPENDIX VI). The classification of this questionnaire was score 5 total dependent (0); score 6 to 20 partial dependent (1); score 21 total independent (2) (SANTOS; VIRTUOSO JÚNIOR, 2008).

Statistical Analysis

Participants were classified according to their level of dependence in performing ADL and IADL. The participants with total independence in both ADL and IADL were ranked as 0; participants with 1 or more functional dependence in the Katz index or, partial or total dependence in the Lawton questionnaire, were considered functionally dependent and ranked as 1. The analyses had been done separetly to the older women and older men, in order to verify the responses of RPE in different genders. RPE arm-curling, RPE sit to stand and performance-based tests were initially investigated through normality and homogeneity of the variance. Spearman's rho correlations (rho) were performed among self-report questionnaires (concurrent validity), RPE in constant-load tests and performance-based test results. The correlation references values were .90 to 1.00 – very high; .70 to .89 high, .50 to .69 moderate, .30-.49 low and .00 to .29 negligible correlation (MUKAKA, 2012).

The older adults were divided in age groups in order to compare the differences between the RPE responses in constant-load tests and the age groups.

The ANOVA one-way was performed to see the differences between the groups: 60-69, 70-79 and 80-over years old.

The intrarater reliability of RPE measurement in the women and men older adults was checked through one-way repeated measures ANOVA and the Intraclass correlation coefficient (ICC) between the 2nd and the 3rd sessions for both physical tasks were also calculated to check the reliability of RPE in constant-load tests. Comparing the RPE in constant-load physical tasks (sit to stand and arm-curling test) throughout the test and retest sessions. The Greenhouse-Geisser correction was used when the Mauchly's Test of Sphericity was significant. When a significant *F*-value was obtained, a contrast test with repeated adjustment was performed for comparison purposes. The ICC references values were <0.7 insuficient, from 0.70 to 0.79 reasonable, from 0.80 to 0.89 and from 0.9 to 1.0 excellent. The first session was not included in this analyze because was a familiarization session.

The diagnostic accuracy of the RPE in constant-load tests was analyzed using receiver operating characteristic curve (ROC) and the area under the curve (AUC), in which an AUC of 1.0 represents a superior test for identifying a condition. In addition, the clinical utility of each variable was evaluated through sensitivity (i.e., a value of test accuracy to identify a condition), specificity (i.e., a value of test accuracy to identify absence of a condition), positive likelihood ratio (LR+: how likely an individual has the condition given and presents a positive test) and negative likelihood ratio (LR−: how likely an individual does not have the condition given and presents a negative test) (FLORKOWSKI, 2008), using ADL and IADL as the comparisons. A positive LR >1 and a negative LR<0.1 were considered to practice highly significant changes in probability, such as to alter clinical management (FLORKOWSKI, 2008).

All statistical analyzes were performed using IBM SPSS Statistics version 22 (IBM Corp, Armonk, New York). The level of significance was set at $p<0.05$.

4.3 Results

The older adults characteristics are presented in Table 4.1. One hundred and sixty-one older adults participated in the study, thirty-eight men (72.13 ± 6.01 years-old; 76.92kg; 167.3 cm) and one hundred and twenty-three women (74.21 ± 5.76 years-old; 64.31kg; 153.95cm). One hundred and six older adults were from the Basic Health Units and fifty-five older adults were from institutionalized places.

Table 4.1 Participants Characteristics

	Age (years)	Weight (Kg)	Stature (cm)	Mini Mental (score)	ADL (score)	IADL (score)	BMI (Kg/m^2)
Women (n=123)	74.21 ± 7.95	64.31 ± 13.91	153.95 ± 6.77	22.94 ± 5.76	5.4±0.9	16.5±4.9	27.05 ± 5.22
Men (n=38)	72.13 ±8.57	76.92±14.08	167.30±6.78	21.63±6.01	5.5±1.1	14.8±4.8	27.46±4.62
All (n=161)	73.72±22.63	67.29±14.91	157.1±8.82	22.63±5.83	5.4±1	16.1±5	27.14±5.08

Concurrent Validity

In the older women analyses the RPE arm curling in constant-load test presented a low correlation with ADL and IADL (Figure 4.5). The RPE in constant-load sit to stand test presented a negligible correlation with ADL and IADL. The performance-based tests analyses presented a low positive correlation with the ADL and sit to stand, arm flexibility and TUG however, presented a negligible correlation between ADL and 4 meters walk, arm curling and leg flexibility. The IADL presented a low correlation between arm curling and sit to stand, however, presented a negligible correlation between 4 meters walk, leg flexibility, arm flexibility and TUG. (Table 4.2 and Table 4.3).

In the older men analyses the RPE arm curling in constant-load test not presented significantly correlation with ADL and IADL (Figure 4.6). The RPE sit to stand in constant-load test presented a low correlation with ADL and did not presented correlation with IADL. The analyses in older men with the performance-based tests, presented a low correlation between ADL and 4 meters walk, arm curling, sit to stand, and TUG and not presented correlation for arm and leg flexibility. The IADL presented low correlation between leg and arm flexibility and not presented correlation between TUG, arm curling, 4 meters walk and sit to stand (Table 4.4 and Table 4.5).

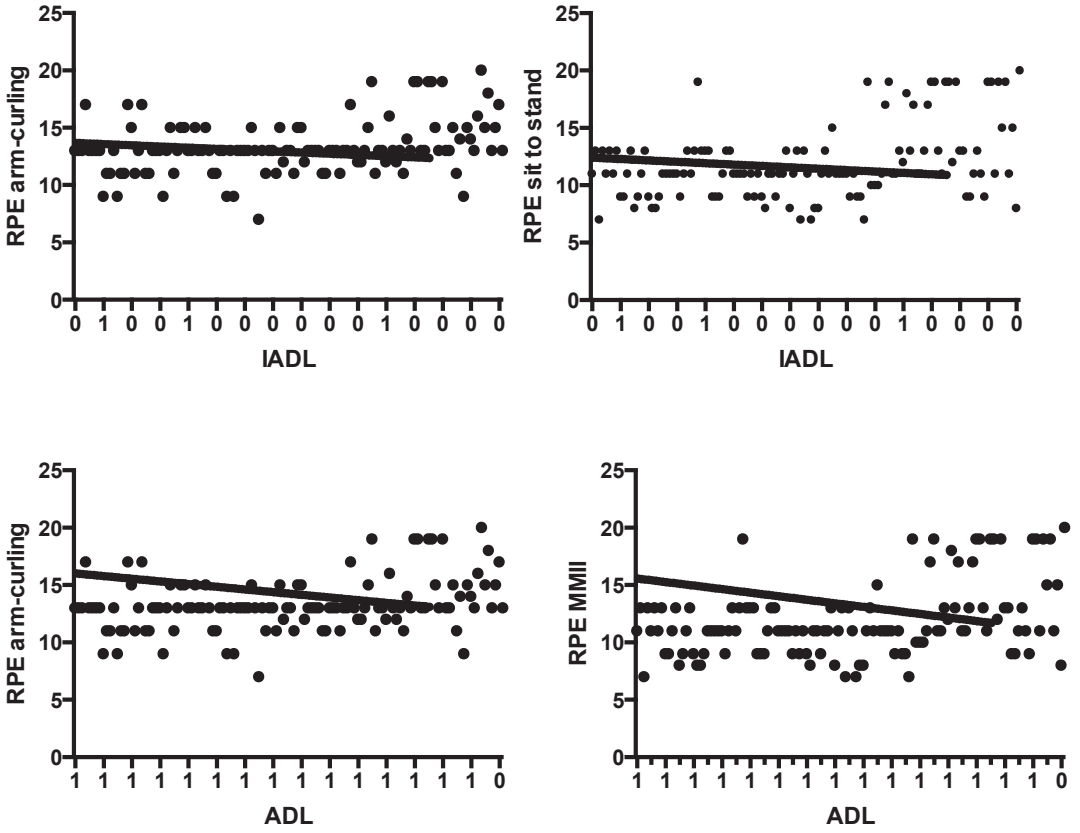

Figure 4.5 Scatter plots of activities of daily living (ADL) and instrumental activities of daily living (IADL) with rating of perceived exertion (RPE) of constant-load in older women. ADL: 0 = independence; 1 = dependence in one function. IADL: 0 = partial dependence or dependence; 1 = independence.

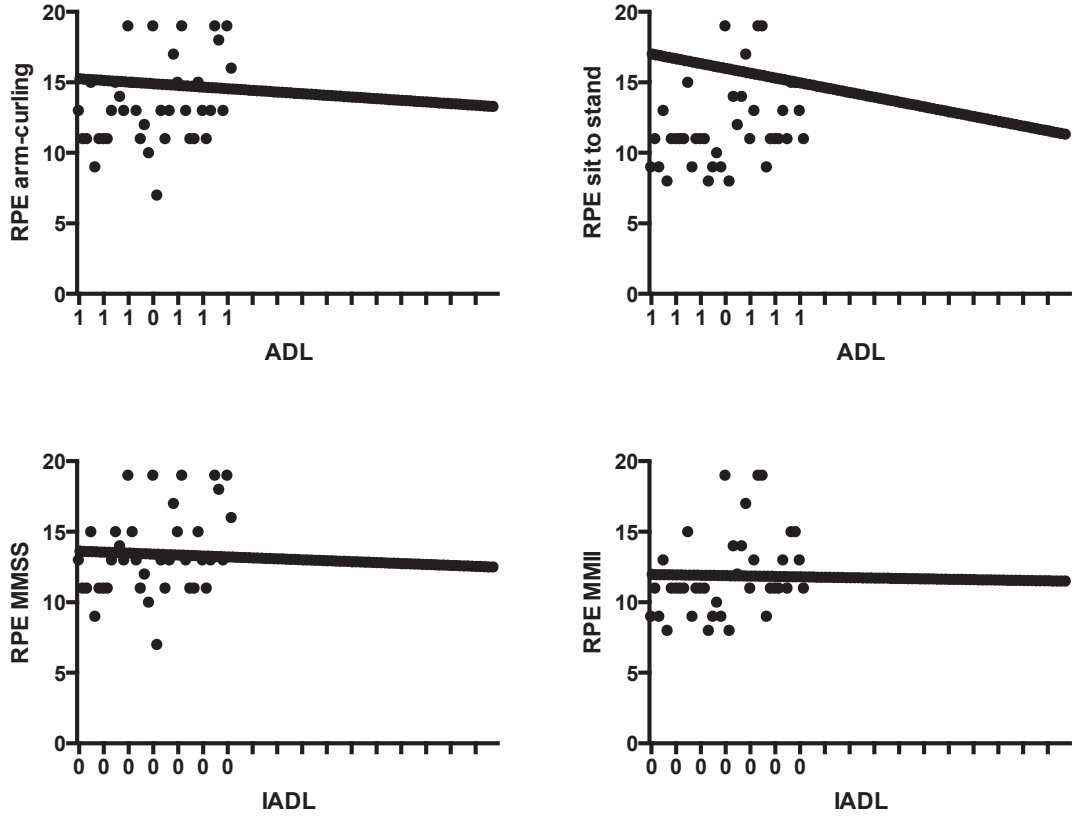

Figure 4.6 Scatter plots of activities of daily living (ADL) and instrumental activities of daily living (IADL) with rating of perceived exertion (RPE) of constant-load in older men. ADL: 0 = dependence in one function; 1= independence. IADL: 0 = partial dependence or dependence; 1 = independence.

Table 4.2 Correlations among perceived exertion, performance-based tests and self-report questionnaires in older women (n=123).

		RPE arm-curling	RPE sit to stand	4 Meters Walk	Sit to Stand	Arm curling	Leg Flex	Arm Flex	TUG
ADL	Rho	-0.33*	-0.27*	-0.299*	-0.313*	.239*	.260*	0.327*	-0.310*
	P	0.000	0.001	0.000	0.000	0.004	0.002	0.000	0.000
IADL	Rho	-0.30*	-0.155*	-0.271*	-0.333*	0.303*	0.188*	0.200*	-0.260*
	P	0.000	0.044	0.001	0.000	0.000	0.019	0.014	0.002

RPE: rating of perceived exertion; ADL: activities of daily living; IADL: instrumental activities of daily living; * $P<0.05$

Table 4.3 Minimum and maximum of the tests in older women and their classification.

	Minimum	Maximum
RPE arm-curling	7	19
RPE sit to stand	7	19
4 meters walking (seconds)	0.46	8.01
Sit to stand (seconds)	6.03	59
Flex mmss (cm)	-66	7
Flex mmii (cm)	-60	17
Arm curling (repetitions)	0	26
Tug (seconds)	6.02	55.1

Table 4.4 Correlations among perceived exertion, performance-based tests and self-report questionnaires in older men (n=38).

		RPE arm-curling	RPE sit to stand	4 Meters Walk	Sit to Stand	Arm curling	Leg Flex	Arm Flex	TUG
ADL	Rho	-0.148	-0.499*	-0.438*	-0.352*	0.396*	0.39	0.317	-0.465*
	P	0.188	0.001	0.006	0.030	0.014	0.815	0.520	0.003
IADL	Rho	-0.108	-0.28	-0.246	0.004	0.082	0.357*	0.321*	-0.102
	P	0.260	0.433	0.136	0.981	0.623	0.028	0.049	0.544

RPE: rating of perceived exertion; ADL: activities of daily living; IADL: instrumental activities of daily living; * $P<0.05$.

Table 4.5 Minimum and maximum of the testes in older men and their classification.

	Minimum	Maximum
RPE arm-curling	8	19
RPE sit to stand	7	19
4 meters walking (seconds)	0.51	2.27
Sit to stand (seconds)	4.09	33.01
Flex mmss (cm)	-65	2
Flex mmii (cm)	-30	3
Arm curling (repetitions)	0	36
Tug (seconds)	5.09	41.06

The RPE in constant-load tests differences between the groups aging; 60-69 years old (n=50), 70-79 (n=73) and 80 or over (n=38) is shown in the Table 4.6. The RPE arm-curling and sit to stand in constant-load tests were different between the 60-69 (12.8 ± 2.6 RPE; 10.9 ± 2.3 RPE, respectively) to 80-over groups (15 ± 2.6 RPE; 13.5 ±3.6 RPE, respectively) ($F=15.43$, $p=0.000$) and between the 70-79 (12.8 ± 2.3 RPE; 11.7 ± 2.8 RPE) to 80-over ($F=13.6$, $p=0.000$). Therefore, the ADL and IADL presented differences between 60-69 to 80-over and 70-79 to 80-over aging groups. The performance-based tests (arm-curling, lower flexibility, TUG and 4 meters walking) presented diferences between the 60-69 to 80-over and 70-79 to 80-over, however the sit to stand just presented diferences between the 70-79 to 80-over and the upper flexibility just presented diferences between 60-69 to 80-over.

Table 4.6 Average and Standard deviation of the RPE arm-curling and sit to stand constant-load tests, ADL and IADL questionnaires and the performance-based tests of the older adults separetly in age groups, 60-69 age groups, 70-79 age groups and 80 – over. *significantly diferent from the 80 – over age groups ($p<0.03$).

	60-69	70-79	80 - over
RPE arm-curling	12.8±2.6*	12.8±2.3*	15±2.6
RPE sit to stand	10.9±2.3*	11.7±2.8*	13.5±3.6
ADL	5.4±1*	5.6±0.5*	4.9±1.3
IADL	16.7±4.9*	17±4.6*	13.6±4.7
Sit to stand	13.6±8	12.7±7.1*	17.1±9.8
LOWER Flex	-7.8±11.3*	-8.3±12.8*	-15±15.3
Upper Flex	-12.2±16*	-17±16.2	-24.2±15
TUG	11.5±6.6*	11.5±7*	16.4±8.7
4 meters walking	3.9±2.3*	4.3±3*	6.4±6.2
Arm-curling	16.3±5.5*	17±5*	13±5.6

Reliability

RPE arm-curling was similar in test and retest ($F_{(2,158)}$=0.174; p=0.67) in older women. RPE sit to stand test was similar in test and retest ($F_{(2,158)}$=0.362; p=0.55) in older women. Moreover, there were very good reproducibility levels (*P*<.001) in RPE arm-curling and RPE sit to stand between the 2nd and the 3rd sessions (ICC=.76; 95%CI: .65 — .83; and ICC=.90; 95%CI: .86 — .93; respectively) (Table 4.7). In the older men group the RPE arm-curling test was similar in test and retest ($F_{(2,37)}$=0.083; p=0.77). RPE sit to stand test was similiar in test and retest ($F_{(2,37)}$=1.53; p=0.22). Moreover, there were good reproducibility levels (*P*<.001) in RPE arm-curling and RPE sit to stand between the 2nd and the 3rd sessions (ICC=.83; 95%CI: .67 — .91; and ICC=.82; 95%CI: .65 — .90; respectively).

Table 2.7 Intraclass correlation coefficient (ICC) and the confidence interval (95% CI) between the test and re-test of the RPE arm curling test and RPE sit to stand test in older women and older men.

	Older women (n=123)	Older men (n=38)
RPE arm-curling	ICC = 0.76 95% CI = 065 – 0.83	ICC = 0.83 95% CI = 0.67 – 0.91
RPE sit to stand	ICC = 0.90 95% CI = 0.86 – 0.93	ICC = 0.82 95% CI = 0.65 – 0.90

Diagnostic Accuracy

The second day of test was used once the data did not present differences between the first and the second day of test. The RPE sit to stand and arm-curling in constant-load tests were analyzed for optimal clinical utility, having IADL and ADL as comparisons, respectively. The AUC in ROC analysis in older women was significant for RPE arm-curling and ADL (AUC =.85; SE=.053; P=.001; 95%CI=.74–.95); RPE sit to stand and ADL (AUC =.79; SE=.092; *P*=.003; 95%CI=.61–.97). The AUC in

ROC analysis was significant for RPE arm-curling and IADL (AUC=.68; SE=.053; *P*=.002; 95%CI=.58–.79) and for RPE sit to stand and Lawton the AUC was not significant (AUC=.59; SE=.054; *P*=.096; 95%CI=.49–.70). The arm curling cutoff score was rating 13 on the RPE scale increased sensitivity (0.82), while decreased specificity (0.52). The sit to stand cutoff score was rating 11 on the RPE scale increased sensitivity (0.89), while decreased specificity (0.34) (Figure 4.7). Furthermore, the RPE arm-curling (LR+ = 1.70; LR– = 0.34) and RPE sit to stand (LR+ = 1.34; LR– = 0.16) evidenced high utility as differentiate dependence in performing self-care activities.

The diagnostic accuracy was perfomed in performance-based testes too. The TUG and IADL was significant (AUC =.66; SE=.049; P=.004; 95%CI=.57–.76) and ADL was significant (AUC =.84; SE=.059; P=.001; 95%CI=.72–.95) in older women (Figure 4.8 and 4.9). The AUC in ROC analysis in older women was significant for arm-curling test and ADL (AUC =.76; SE=.061; P=.008; 95%CI=.64–.88); arm-curling test and IADL (AUC =.69; SE=.053; *P*=.001; 95%CI=.59–.79) (Figure 4.10 and 11). Sit to stand test and IADL was significative (AUC =.71; SE=.049; P=.000; 95%CI=.61–.81) and ADL (AUC =.84; SE=.049; P=.001; 95%CI=.75–.94) (Figure 4.12 and 13).

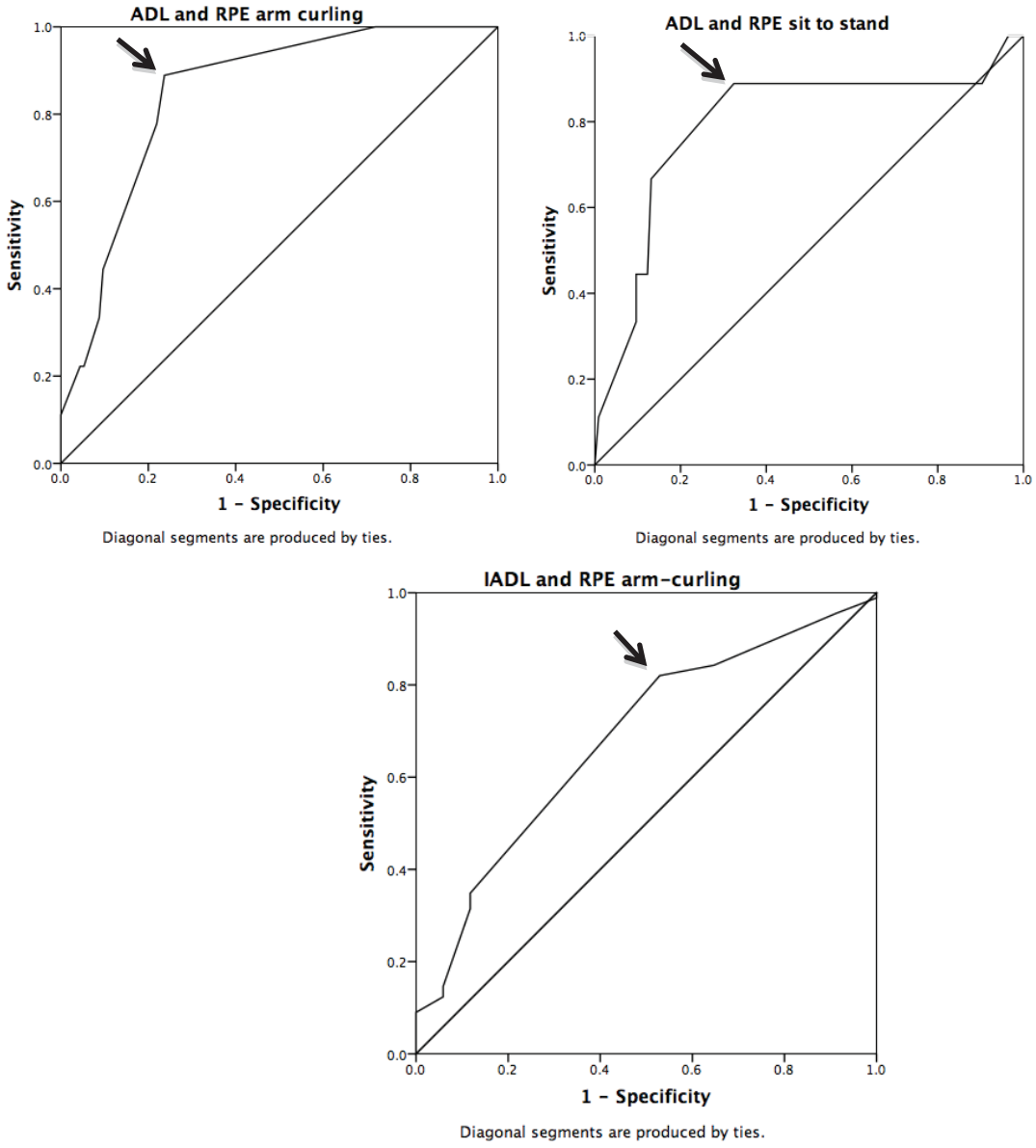

Figure 4.7 Receiver operating characteristics curves between RPE in constant-load tests and the questionnaires in older women. The arrows in the RPE arm-curling indicate a rating of 13 as cutoff score. The arrows in the RPE sit to stand indicate a rating of 11 as cutoff score.

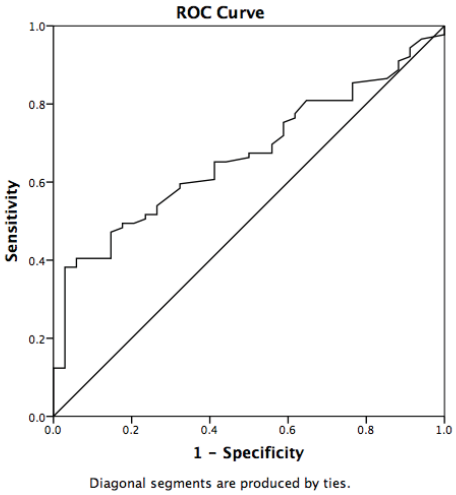

Figure 4.8 Receiver operating characteristics curves between TUG and IADL in older women.

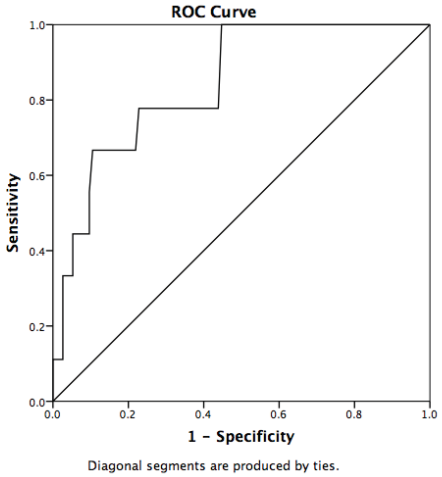

Figure 4.9 Receiver operating characteristics curves between TUG and ADL in older women.

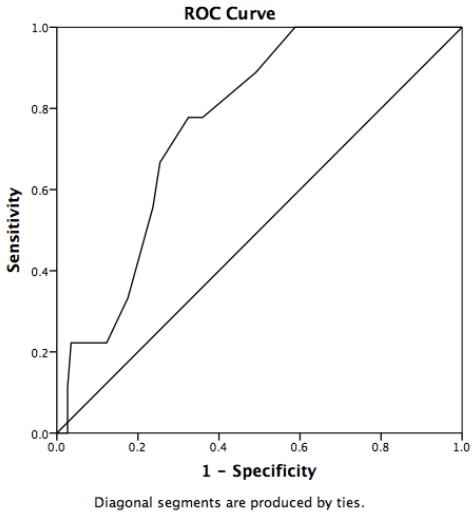

Figure 4.10 Receiver operating characteristics curves between arm-curling test and ADL in older women.

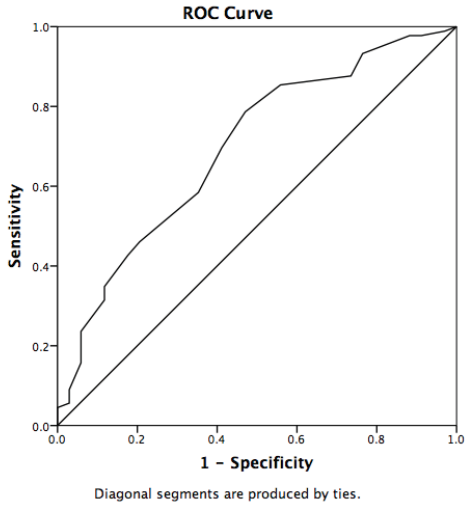

Figure 4.11 Receiver operating characteristics curves between arm-curling test and IADL in older women.

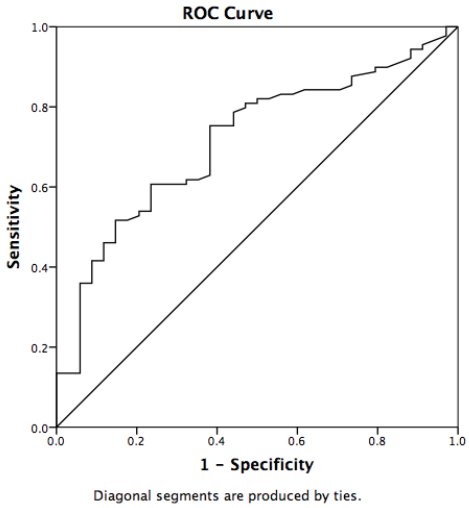

Figure 4.12 Receiver operating characteristics curves between sit to stand test and IADL in older women.

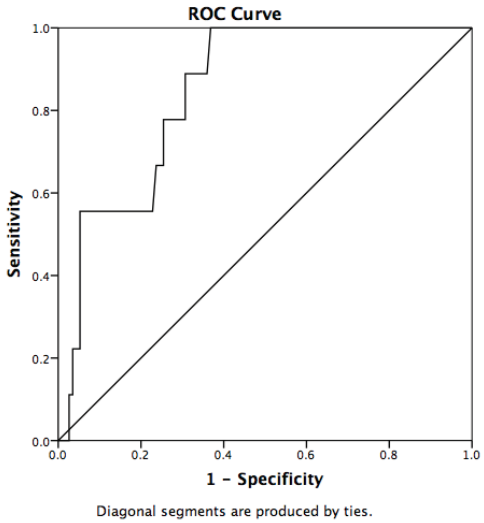

Figure 4.13 Receiver operating characteristics curves between sit to stand test and ADL in older women.

In the older men, the AUC in ROC analysis was only significant for ADL and RPE sit to stand (AUC=.95; SE=.033; P=.003; 95%CI=.89–1.0), for ADL and RPE arm-curling was not significant (AUC=.63; SE=.155; P=.379; 95%CI=.33-.94). The AUC in ROC analysis did not present significant for the RPE arm curling and ADL. The IADL and RPE sit to stand (AUC=.52; SE=.142; P=.86; 95%CI=.24-.80) and arm curling (AUC= .59; SE=.126; P=.52; 95%CI=.35-.84) were not significant. The sit to stand cutoff score was rating 11 on the RPE scale increased sensitivity (1), while decreased specificity (0.29) (Figure 4.14). Furthermore, RPE sit to stand (LR+ = 1.40; LR– = 0) evidenced poor utility as screening measures in self-care activities.

The diagnostic accuracy was perfomed in performance-based testes too. The TUG and ADL was significant (AUC =.93; SE=.044; P=.005; 95%CI=.85–1.0) and IADL was not significant (AUC =.59; SE=.152; P=.536; 95%CI=.29–.89) in older men (Figure 4.15). The AUC in ROC analysis in older women was significant for arm-curling test and ADL (AUC =.87; SE=.062; P=.016; 95%CI=.75–.99); arm-curling test and IADL was not significant (AUC =.57; SE=.151; *P*=.617; 95%CI=.28–.87) (Figure 4.16). Sit to stand test and IADL was not significative (AUC =.50; SE=.177; P=.981; 95%CI=.15–.85) and was significative in the sit to stand and ADL (AUC =.83; SE=.072; P=.032; 95%CI=.68–.97) (Figure 4.17).

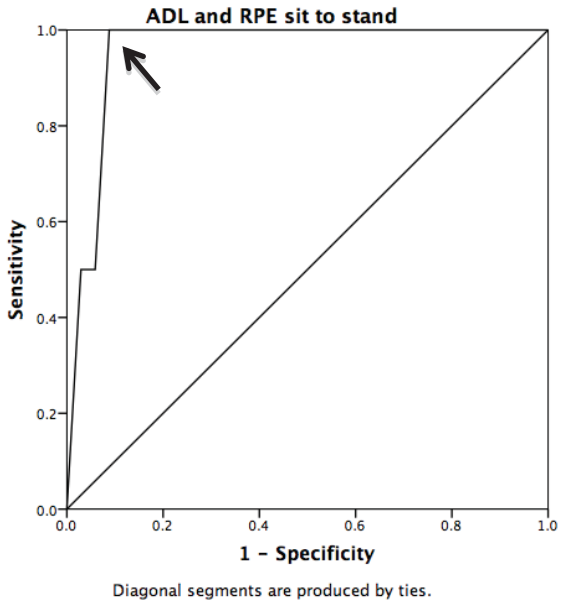

Figure 4.14 Receiver operating characteristics curves between RPE sit to stand and ADL in older men. The arrows in RPE sit to stand indicate a rating of 13 as the cutoff score.

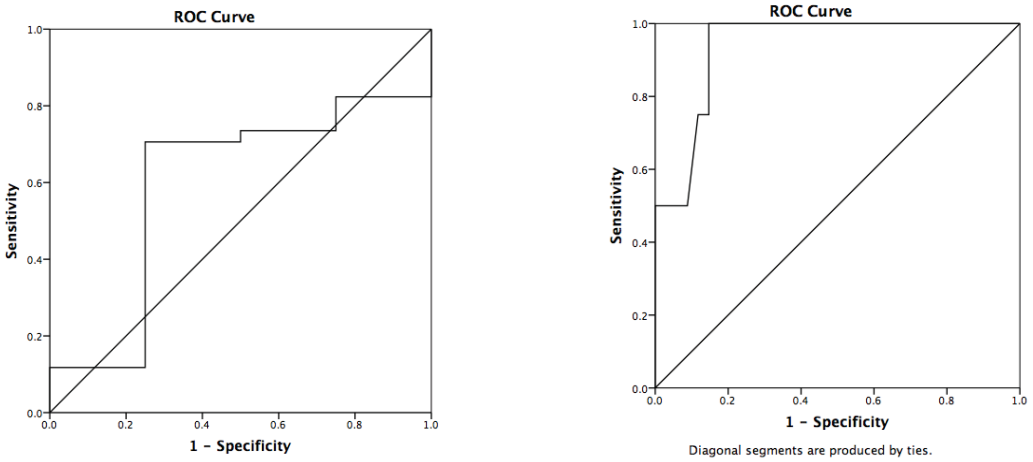

Figure 4.15 Receiver operating characteristics curves between TUG and IADL in the left and ADL in the right in older men.

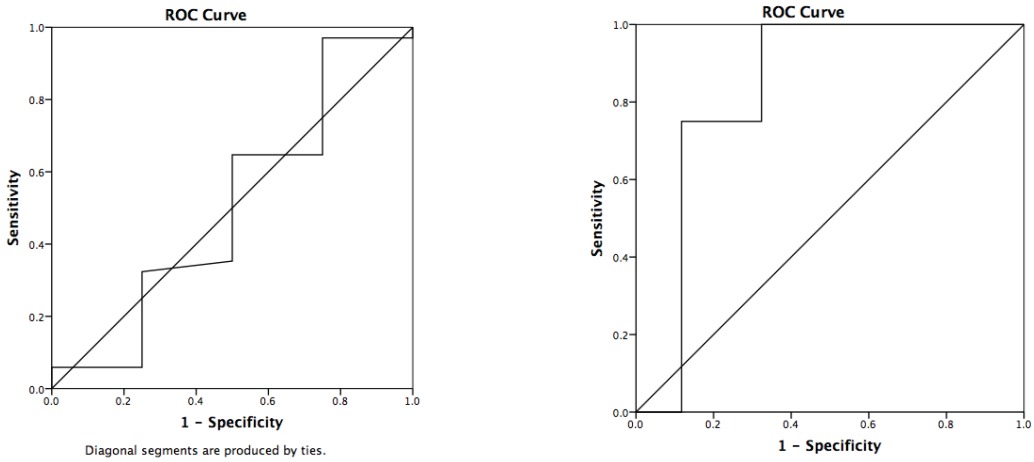

Figure 4.16 Receiver operating characteristics curves between arm-curling test and IADL in the left and ADL in the right in older men.

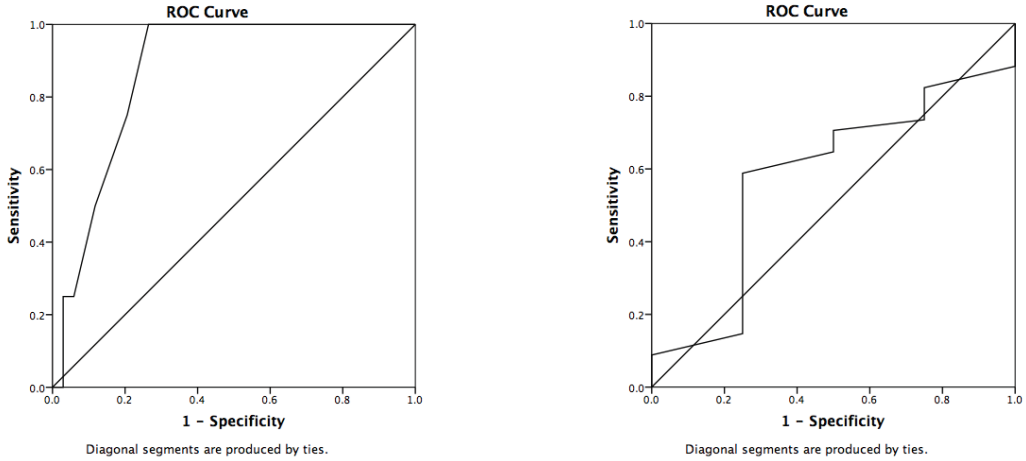

Figure 4.17 Receiver operating characteristics curves between sit to stand test and IADL in the rigth and ADL in the left in older men.

4.4 Discussion

The aim of this study was to verify whether perceived exertion in constant-load tests has the ability to differentiate dependence level in performing activities of daily living in older adults. The RPE arm-curling in constant-load test presented concurrent validity in older women using self-care activities questionnaires as a criterion and RPE sit to stand in constant-load test presented concurrent validity in older women and men. The RPE constant-load tests showed a good level of reliability and evidenced a diagnostic accuracy to differentiate independent from dependent in performing self-care activities in older adults.

The RPE arm-curling had presented concurrent validity with the questionnaires that evaluate the level of dependence in performing self-care activities to older women and RPE sit to stand to older women and men. Perceived an increase in exertion during any physical task related to working capacity may be easier to older adults than perceive a decline in working capacity (asked in questionnaires) (BORG, 1998), once it is easier to the older adults do not remember the exertion in some physical tasks at home or they can lie about the capacity to perform the activities of daily living. In addition, older adults who have a higher physical fitness level will perceive less effort and fatigue in the activities of daily living than older adults that have a lower physical fitness level. However, these perceptions are difficult to find in the performance-based tests, once they can choose the intensity that they will perform the test in order to achieve their best score. In performance-based tests the older adults may adjust their speed, with the objective to spend less energy and maintain a lower perceived exertion (HOVINGTON; NADEAU; LEROUX, 2009). In the present study, the same speed was applyed for

everyone to avoid different intensity in the RPE in constant-load tests performance for the older adults. The RPE in constant-load tests presented a concurrent validity which is related to the scores of the questionnaires and the responses in RPE constant-load tests, considering the most used test to predict the dependence level in older adults (KATZ; STROUD., 1989; LAWTON; BRODY, 1969). Finally, the RPE arm-curling constant-load test has been related to older women, besides that RPE sit to stand has been related to older women and men.

The physical activitiy level in the daily living activities can explain the older women correlation with the RPE arm-curling test. The arm strength is request more in activities of daily living, such as bathing, eating, dressing, laundry and preparing meals. Consequently, the arm strength can be higher in the older women that perfom this activities than the older men that did not perform such activities. Furthermore, the older men have been performed predominantly the job activites, that is related to the yard, working outside the house and the activities that request more body strength. The physiological charactheristics of these activities cause less reduction in older men strength during the aging process than older women. However, the older men have high levels of strength and functioning in the arms, although the most men do not perform the self-care activities as well as older women, having a score of dependence in activities of daily living (LEVEILLE; RESNICK; BALFOUR, 2000). They presented less RPE in arm-curling test and higher level of dependence in the tests. Although, the questionnaires did not focused in these components, they just ask if the older adults did or did not do the basic and instruments activities of daily living. This argument can highline a limitation of the questionnaires, which presented a relationship with diagnostic the dependence in perfoming self-care activities in older women, once they performed more these activities than older men. The

questionnaire limitation could influence on the non-concurrent validity with RPE arm curling in older men and the small number of older men in the study did not allow the concurrent validity, once a larger number of older men can give a view of the response of a world population. Therefore, RPE responses are effective to measure the dependence in activities of daily living in older women, once the questionnaire takes into account the ability to do the activities of daily living and the RPE could encompass more capacities that influence the performance of activities of daily living.

The RPE arm-curling and walking constant-load tests presented high to very high correlation in Souza et al., (2018) study, in contrast the present study indicated a low correlation between RPE tests and questionnaires. One reason that can influence the differences between the low and high correlation was that in the present study the randomization, since the screening of the number of participants. Therefore, the study of Souza et al., (2018) did not present the randomization and evaluated a small number of older women. In the present study was choosen the Basic Health Units institution to collect the data in order to achieve a large number of older adults, however the results could be higher if the RPE tests had been done in a place that older adults can be more concentrated. Further, the mini mental state was not used as a criterion to the participants selection. Therefore, the present study did not choose to use a mini mental cutoff point, once the majority of older adults was poor and illiterate in the community. The population characteristics were considered a limitation in order to give a cutoff point to the older adults in the mini mental, low values in the test and the standard deviation of the results make difficult to use a cutoff point. Finally, the present study changed the walking test that was proposed by Souza et al., (2018) to the RPE sit to stand test to be more similar to the daily activities, once RPE walking test may be more difficulty to perfom than sit to stand

test. All these arguments may influenced the results, however the present study confirmed the concurrent validity of RPE in constant-load test and dependence in performing self-care activities despite the low correlation.

The lower correlations between performance-based tests and ADL and IADL questionnaires showed the same pattern of correlation than the RPE in constant-load tests and questionnaires. The results obtained in the performance-based tests had considerable concurrent validity with dependence/independence statuts in ADL and IADL that is similar to the RPE in constant-load tests concurrent validity. Souza et al., (2018) found a higher correlation between RPE in constant-load tests and performance-based tests correlation, the characteristic of the present study can influence these divergent results. Thus, the RPE tests can be applied in a community setting, are easy to administer, safe for participants, low cost and not depend on the motivation. Therefore, it could be hypothesized that the RPE constant-load test would predict dependence in performing self-care activities as well as the performance-based tests.

Another finding of this study was that RPE arm-curling and sit to stand in constant-load test could differentiate the older adults stratified in different age groups. The older adults over 80 years group presented a higher RPE responses than 60 to 69 group and 70 to 79 group RPE responses. The older adults (over 80 years) presented higher RPE responses than the younger ones. Therefore, the ADL and IADL responses presented a decrease for the ADL and IADL dependence on the 80 to over group compared to the 60-69 and 70-79 age group. Thus, the IADL and ADL from the older adults (over 80 years) presented higher values than the younger ones; confirming the hypotheses of the study which states that there was a relation in a high level of dependence in performing activities of daily living with a high RPE in the

constant-load tests. The other point is that the performance-based tests presented the same differences, however it was not all the tests that presented the difference between the age groups. These confirmed the study hypotheses that older adults that presented a great level of dependence in performing self-care activities would perform the RPE in constant-load tests with more difficult, consequently with a higher RPE responses. The older adults over 80 years are already more physically debilitated than the younger ones and have greater probability to be dependent in activities of daily living (LEVEILLE; RESNICK; BALFOUR, 2000). A tool that can differentiate the dependence in performing self-care activites is a good characteristic to evaluate older adults. Once the capacity to differentiate older adults age group is considered the sensitivity of an instrument to the improvements and changing in the population studied (CURRELL, K; JEUKENDRUP, A, 2008). One study that can be done is the comparison between the older adults and young adults to see if this tool can differentiate them. Finally, it is possible to conclude that RPE in constant-load tests can detected the changes between stratified different age groups in older adults.

Intraclass reliability values for tests items ranged from .65 to .93 – with a majority of the values being .86 or above, indicating that the tests have high relative reliability across trials in different days. The reliability of the RPE in constant-load tests was similar in the test and retest to the RPE arm-curling and sit to stand test. One day of familiarization session had been very important to the understanding of perceived exertion scale and instrument application (CABRAL et al., 2017). The conclusion of a familiarization session is essential to ensure validity of data collection (ESTON, 2012; ESTON; WILLIAMS, 1988). A familiarization session avoid any under or overestimation of perceived exertion, and also ensure that subjects are able to

dissociate effort from other exercise-related sensations (PAGEAUX, 2016). Another important feature that can be highlighted is the instructions that have been explained to the older adults about the perceived exertion (CABRAL et al., 2017). The instructions should be cover the definition of effort and should explain what the participant need to report (e.g. pain, discomfort), for these reason the subject should have the opportunity to ask questions (PAGEAUX, 2016). It seems that instructions and familiarization session that had been given to older adults are important to apply a good test, achieve correct answers at the end and to confirm the reliability of the test. The results of this study showed that the RPE constant-load tests presented a higher reliability for older men and women.

The ROC curve analyses have been calculated to detect the diagnostic accuracy of RPE in constant-load tests to differentiate the independent from dependent older adults in performing self-care activities. The cutoff RPE to identify a true positive case (i.e., dependence in ADL and IADL) was 13 on the Borg 6-20 Scale when considering arm-curling constant-load test for older women. Findings suggest that older women should be considered dependent in performing self-care activities when their RPE is more than 13 after 1 minute of arm curling test. The cutoff point of 13 RPE in arm-curling test can be used just for older women, once the concurrent validity of this variable was only with them. However, in the sit to stand test the cutoff RPE to identify a true positive case was 11 RPE, hence the older adults (men and women) will be considered dependence in performing self-care activities when their RPE is ≥ 11 (Borg Scale). Tests that can discriminate disease and health older adults is very usefull and necessary to the area of study in older adults, once it is important to predict the disease state before the it gets worse (EUSEBI, 2013). The capacity of a test to accurate diagnoses is essential for

choosing adequate interventions (DE OLIVEIRA AZEVEDO MATOS; DE ALMEIDA LOPES MONTEIRO DA CRUZ, 2009) and to give the correct treatment to older adults. The RPE in constant-load test can be considered a good and easier measurement to diagnostic accuracy the dependence in performing self-care activities in older adults.

Some methodological limitations of this study should mention. In the analysis by sex, the most important limitations were due to the size of the small sample of older men. The non-use of cutoff points in the mini mental test to select the participants was considered limitation too. Thus, a study with a large number of older men is important to confirm the relationship between RPE in constant-load tests and dependence in performing self-care activities. These findings allow healthcare professionals that work with older adults to accurately assess and classify dependence in performing self-care activities in older adults through the RPE in constant load tests. The purpose of this approach was to control the test intensity in order to minimize the motivational effects on test results and assessment of changes in functional status across time (within-subject comparisons). The RPE in constant-load tests presented an alternative to differentiate dependence in performing self-care activities in older women, however in older men the RPE in constant-load tests could be an alternative but not too strong than women.

4.5 Conclusion

The RPE sit to stand and arm-curling in constant-load tests presented ability to differentiate dependence in performing activities of daily living in older adults. The RPE in constant-load tests presented a concurrent validity, a good reliability and

capacity to diagnostic the dependence level in performing self-care activites. The cutoff point to detect the diagnostic accuracy of the RPE in the arm curling was 13 RPE in older women and in the sit to stand was 11 RPE in older men and women. The RPE in constant-load tests presented an alternative to differentiate dependence level in performing self-care activities in older adults, however in older men could be an alternative to discrimate instrumental activities but not the basic activities.

CHAPTER 5

Sensitivity of the Perceived Exertion in constant-load tests after a period of Multicomponent Training in Institutionalized Older Adults

5.1 Introduction

The older adults that live in an institutionalized home show more decrease in functional capacity than the community ones (LEVEILLE; RESNICK; BALFOUR, 2000). Fifty percent of older adults residing in long-term care facilities have significant levels of physical disability and thirty percent present total or severe dependency (JEREZ-ROIG et al., 2017). This aspect must be emphasized once 30% of older adults have experienced decline in physical activity after entry into a residential care (PERI et al., 2008). Therefore, in order to give a better quality of life to older adults, it has been crucial to prevent and/or to revert the process of dependence in performing self-care activities, considering they have been increasing (MATTOS et al., 2014). The institutionalized older adults present a low level of dependence in performing self-care activites than older adults that live in community, it is easier to find dependence older adults in a institutionalized place than to find them in the older adults that frequently the physical activitiy in the community.

Older adults who spend more time in physical activity or less time in sedentary behaviors can revert the decrease in functional capacity (FURTADO et al., 2015; RIKLI; JONES, 1999, 2013). Previous studies indicate that older adult physically active has performance patterns of cardiovascular fitness, muscular strength, power, balance, agility, and flexibility more similar to younger participants than to their older inactive peers (GANSE et al., 2014). Studies have focused in an exercise that can improve dependence in performing self-care activities in institutionalized older adults, even though they have less level of physical activity and consequently present more dependence in performing activities of daily living (AYAN et al., 2013; CADORE et al., 2013, 2014; SAMPAIO et al., 2016). Multicomponent exercise training (MCT)

programs that involves the walking, flexibility, balance exercises, cardiorespiratory period and neuromuscular exercise have shown a contribution to a healthier, active and more independent live in institutionalized older women (FURTADO et al., 2015). Exercise program that encompass work of some physical components seem to result in greater overall functional capacity gains, once multicomponent training stimulates several physical components. The MCT are considered one exercise prescription for seniors to revert the dependence in performing-self-care activities (CHODZKO-ZAJKO et al., 2009). However, to find specifics instruments that can evaluate the benefits in dependence level in performing self-care activities after a multicomponent training period in institutionalized older adults have been considered a limitation of some studies.

The chosen instruments to assess the efficient of the training to improve or not the dependence level in performing self-care activities have been considered crucial, once if you evaluate in a wrong way it is difficult to give a correct conclusion. The instruments that have been used to evaluate the dependence level in self-care activities after a period of training have not been specific validated, such as performance-based tests. They did not present the specificity to differentiate trained older adults from untrained ones. Therefore, it is crucial to validate an instrument that can differentiate dependence in performing self-care activities after an exercise program in older adults in order to see the benefits of the training in the independence level. This have been considered a reason to divergents results in many studies that used performance-based tests to verified the effects of training in functional capacity, some studies found improvements, despite others did not find (CADORE et al., 2014; LOPES et al., 2016; NELSON et al., 2007). However, performance-based test battery evaluate physiologic parameters that support

physical mobility in older adults (GURALNIK et al., 1995), presenting no relation to measure training effects (RIKLI; JONES, 1999). In addition, the motivation can be different from trained older adults to untrained ones influencing the results. The trained older adults were more motivated and felt improvements after training program than untrained ones (MEURER et al., 2012). However, perceived exertion in constant-load tests could be a potentially tool to evaluate improvements in dependence in performing self-care activities after training, once this instrument have already presented concurrent validity and reliability. The RPE in constant-load tests presented good indicators to confirm sensitivity in trained and untrained older adults after a training program.

It has already been demonstrated in a previous study (SOUZA et al., 2018) and in the previous Chapter of this thesis that RPE has been able to differentiate dependence in performing activities of daily living in older adults, especially in women (SOUZA et al., 2018). However, the instrument sensitivity had not been evaluated, in order to verify the sensitivity of RPE in constant-load tests on changing in dependence in performing self-care activities after a training program. The sensitivity of an instrument could be verified as the ability to measure the effects after a period of training, differentiating scores in two or more conditions (PASQUALI, 2009). It is interesting verify the sensitivity of an instrument that predicted the dependence level in performing self-care activities, once the instruments that have been used did not present sensitivity after a period of training. The physical fitness influences the RPE responses, thus older adults that presented a better physical fitness will reporte lower RPE. After a period of training, the levels of physical fitness will increase and consequently decrease RPE in constant-load tests responses. Nevertheless, the RPE in constant-load tests could be used to verify the training effects (JULIUS et al.,

2012), considering the relationship between the RPE and the physical fitness that can be improved after training. Finally, in order to quantify the training effects in the level of dependence in performing self-care activities in older adults and give another option to evaluate the level of dependence is essencial to verify the sensitivity of RPE in constant-load tests.

Therefore, the aim of this study was to verify the sensitivity of perceived exertion in constant-load tests (sit to stand and arm curling) to differentiate the improvements in dependence in performing self-care activities after a period of multicomponent training in institutionalized older adults.

5.2 Methods

Eleven government-institutionalized homes in Curitiba city (Paraná- Brazil) were contacted regarding their interest in participating in this study. Two facilities agreed to participate and data collection occurred over a 16-week period. The University Research Ethics Committee approved the project (CAAE: 56119316.0.0000.5221) and an informed consent was obtained from all participants (APPENDIX VII and APPENDIX VIII). The research group provided a study explanation, including a description of associated risks and benefits for the participants. The study was registrated in the Brazilian Clinical Trials Registry / Brazilian Registry of Clinical Trials (ReBEC), registration of ongoing experimental and non-experimental studies on humans performed in Brazil, and was approved by the number of protocol RBR-7xzcqp.

In collaboration with facility nurses, 40 eligible participants were identified and invited to participate in the study. Participants were required to be 60 years or older; able to walk with or without assistance of devices (e.g. cane, walker); and

dependence in at least one ADL and IADL (LINO et al., 2008; SANTOS; VIRTUOSO JÚNIOR, 2008). Participants that used a wheelchair and had a health condition that precluded them from understanding the questionnaires and/or performing the functional tests (e.g. severe cognitive impairment, neurological, musculoskeletal and decompensated heart, among others) were excluded. A total of 30 institutionalized older adults were enrolled in this study, during the training period 5 older adults gave up, which the reason is describe in the Figure 5.1. Following pre-testing, participants were assigned to one of two groups according to TUG and 4 meters walking stratification, the participants had been allocated considering the results of this tests in order to balance the older adults in the two groups. Twelve older adults participated in control group (CG, 4 men and 8 women, mean age = 72.4 $\pm$ 8.9 years) and 13 older adults participated in multicomponent group (MCT, 5 men and 8 women, mean age = 69.2 $\pm$ 7.3 years). The control group was invited to not participate in an exercise program during the study.

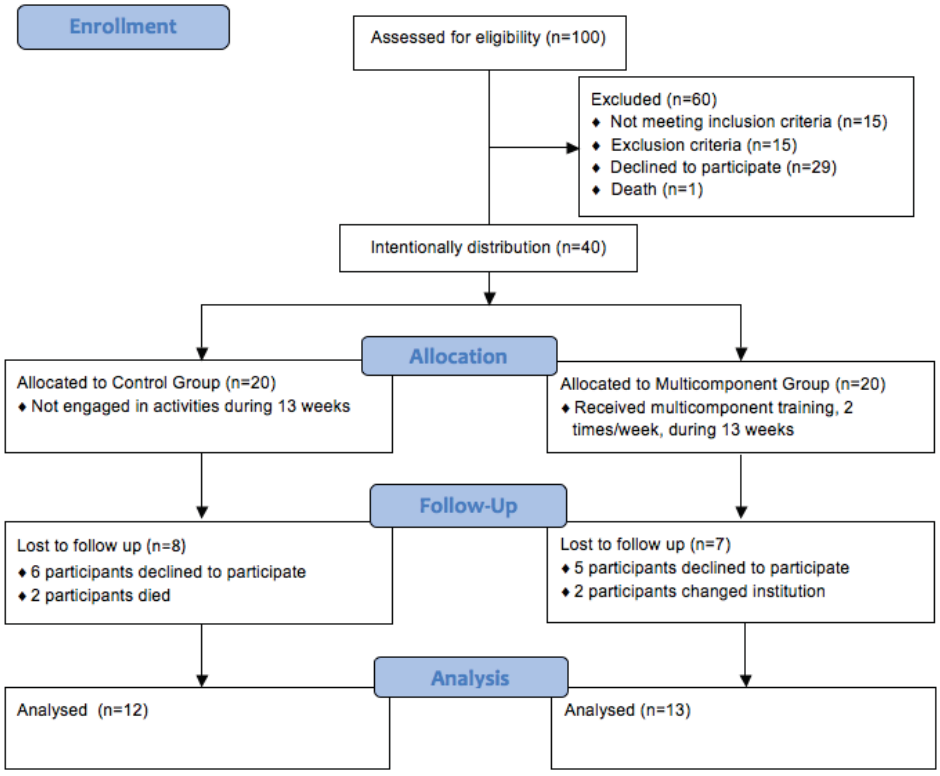

Figure 5.1 Flow chart of the study.

Experimental Design

The participants were evaluated pre-training (PRE) in 2 testing sessions, held 2-9 days apart from each other. In the first session they completed the Mini Mental State Examination (MMSE) to assess cognitive function along with Katz Index of Independence in Activities of Daily Living (KATZ) and Lawton & Brody IADL questionnaires (LAWTON). Following completion of the questionnaires, participants' weight and height were measured to determine body mass index (BMI). Functional capacity was assessed using a battery of tests including: five time sit to stand test, arm curl, chair sit-and-reach, back scratch, time up and go test (TUG), 4 meter walk and balance (Berg Balance Scale - BBS). In addition, participants completed a familiarization with Borg 6-20 scale reporting their RPE at the end of each constant-

load test (modified protocols for sit to stand and arm curling tests), as described in the following section. In the second session, participants performed RPE sit to stand and arm curling in constant-load tests, afterward they executed the Six Minute Walk Test.

Participants in the experimental group were assigned to an exercise intervention, which consisted of MCT training on two days per week for a total of 13 weeks. Participants in the control group (CG) were asked to maintain their normal routines and to not engage in a training program during the 13 weeks of the study. Following the 13-week training period, all participants completed post-training testing (POST).

Measures

Mini Mental State

The Mini Mental State (MMS) is divided into two parts, the first of which requires vocal responses and orientations, memory, and attention; the maximum score is 21 (FOLSTEIN; FOLSTEIN; MCHUGH, 1975). The second part tests the ability to name, follow verbal and written commands, write a sentence spontaneously, and copy a complex polygon; the maximum score is nine. Maximum total score of the MMS is 30. Scores on the MMS relate to the degree of cognitive function and is dependent for the scholarship: a score of 20 points for illiterates, 25 points for the older adults with one to four years of study, 26.5 points for the older adult with five to eight years of study, 28 points for those with 9 to 11 years of study and 29 points for those over 11 years old of study. The dementia severity was definied as moderate for

those with a MMS >10 but < 20 and mild dementia for those with a MMS ≥20 (ATHERTON et al., 2016). The study did not use a cutoff point of mini mental test for inclusion/exclusion criteria.

Katz Index of Independence in Activities of Daily Living Scale Questionnaire

Performance in activities of daily living (ADL) was measured using the cross-cultural adaptations (to Brazilian Portuguese) of Katz Index of Independence in Activities of Daily Living (KATZ; STROUD., 1989). The Katz Index required participants to report any instances where they needed help in performing any ADL (i.e., bathing, dressing, toileting, transferring, continence and feeding). The Katz Index is composed by 6 questions and permits ranking older adults in 1 and 0 point in these ADLs. Older adults who score 0 in the question cannot perform alone or need some help to complete the ADL and 1 point is when older adult performs independently the activity (LINO et al., 2008). Scores on Katz Index relate to the degree of dependence in basic self-care activities: A score of ≤ 2 indicates a high degree of dependence, a score of 2 to 4 indicates moderate dependence and 5 to 6 items indicates functional independence (DUARTE; DE ANDRADE; LEBRÃO, 2007).

Lawton & Brody Instrumental Activities of Daily Living Scale Questionnaire

Lawton and Brody questionnaire required participants to report their ability to perform any IADL (shopping, cooking, housekeeping, use of telephone, medication control, finances and transport) (LAWTON; BRODY, 1969). The Lawton questionnaire is composed by 7 questions and permits ranking the older adults in 1 to 3 points in these IADLs. One point is when older adult can not perform alone or do

not have the habit to do it, two points is when the older adult perform the task but they need some help and three is when the older adult do independently the activity (SANTOS; VIRTUOSO JÚNIOR, 2008). Based on their scores, participants were classified as completely dependent (≤ 5 points), partially dependent (6 to 20 points) or completely independent (≥21 points) (SANTOS; VIRTUOSO JÚNIOR, 2008).

Performance-based tests

Functional capacity was evaluated through five items taken from the Senior Fitness Test (RIKLI; JONES, 1999). Upper body flexibility was assessed using back scratch test, which involves reaching behind the head with one hand and behind the back with the other toward a specified anatomical point on the opposite scapula. The chair sit and reach measure lower body flexibility, that consisted in the participant sits on a chair and extends one leg straight out in front of the hip, the objective is to reach as far forward as possible toward the toes. The lower body strength was assessed using the five time sit to stand test with participants completing 5 repetitions of the sit to stand movement as quickly as possible (WHITNEY et al., 2005). Upper body strength was assessed using the arm-curling test in which participants were asked to perform an arm curl using either a 2-kg (females) or a 3-kg (males) weight, completing as many repetitions as possible in 30 seconds (RIKLI; JONES, 1999). The TUG test was used to assess dynamic balance, in which participants began seated in a chair and upon hearing the signal, stand up out of the chair and walk a distance of 3 meters and return to a seated position (RIKLI; JONES, 1999). These five tests were completed on the first day of testing and were performed with a rest period of 2 minutes between tests.

Walking speed was estimated using Four Meter Walk Test (GRAHAM et al., 2008; ROGERS et al., 2003). In this test, participants were asked to walk as they normally do for a total of 8 meters in a straight line, with lines on the floor demarcating distances of zero, 2 meters, 6 meters, and 8 meters. Participants were timed between for 4 meters (between the 2 meter and 6 meter markers) in order to allow for acceleration and slowdown. Gait speed (in meters/second) was calculated by dividing 4 meters by the time (in seconds) to walk 4 meters. The test was repeated three times, with standardized instructions, and the best performance was used to determine the score (GRAHAM et al., 2008; ROGERS et al., 2003). Gait speeds of less than 1 meter/second were considered insufficient (STUDENSKI; PERERA; PATEL, 2011).

The Six Minute Walk Test was used to evaluate aerobic endurance (RIKLI; JONES, 1999). In this test, each participant walked back and forth on a 30-meter track and the total distance (in meters) covered within six minutes was recorded (American Thoracic Society, 2002). Participants were allowed to slow down and/or take a short rest; however time continued to run. Each participant performed the test individually so as not to disturb or be influenced by the performance of others (STEFFEN TM, HACKER TA, 2002).

Mobility and balance were assessed using the Berg Balance Scale (BBS). The BBS is composed by 14 items to assess multiple dimensions of balance and has been validated for use in frail older adults (FIGUEIREDO; LIMA; GUERRA, 2007; GILL; WILLIAMS; TINETTI, 1995; STEFFEN TM, HACKER TA, 2002). The activities vary from simple tasks, like maintaining one's stability in standing, to dynamic tasks involving changing the base of support or performing movements with increasing speed. Each item is rated on a scale of 0 (inability to perform) to 4 (able to perform

the task safely), with a maximum score of 56 for full test battery.

Perceived exertion in constant-load physical tasks

Perceived exertion had been defined as the conscious sensation of how hard, heavy, and strenuous a physical task is (MARCORA, 2010). Therefore, in this study the RPE was used in a constant-load task simulating activities of daily living. Before each session day, the participant received instructions about using the Borg 6-20 RPE scale, as previously reported (SOUZA et al., 2018). The perceived exertion depends on how difficult is to exercise with the legs or arms, how difficult is to breathe and overall feelings of tiredness for exercise (MARCORA, 2010). Participants were advised about the exercise duration and workload. The RPE scale was measured during two constant-load physical tasks. The 1st physical task was to sit and stand on a chair during 1 min, the intensity was controlled signaled an electronic metronome that was programed for 4 seconds to stand and 4 seconds to sit. The 2nd physical task was arm curling, participants were required to flex and extend both elbows simultaneously while holding dumbbells (2kg for women and 3kg for men each side). The intensity was controlled by the electronic metronome, which was programed for 1 second to curl and 1 second to extend, 30 repetitions during one minute. Immediately after the physical tasks, participants reported their perceived exertion using Borg 6-20 category Scale (BORG, 1998). There were given a rating of 19 RPE scale when the participant cannot be able to accomplish the whole task due to exhaustion. Between the constant-load physical tasks, participants either rested during 3 min in a chair. The instructions were the same as described in section 4.2.

Multicomponent training program

The experimental group completed 13 weeks of MCT designed to improve strength, balance, cardiovascular system and gait. Participants exercised twice per week on non-consecutive days. Each exercise session included 4-7 participants and took place in specific rooms with pleasant music, chosen by the participants, playing in the background. The duration of training sessions lasted for approximately 45 min. Three trainers led the exercise sessions, 1 graduated in physical education and specialized in older adults and the others undergraduted in physical education. The control group was asked to not enter in an exercise program during the 13 weeks of the study. The control group had a meeting after 15 days that was talking about the physical activitiy, health and some cognitive activities during these sessions.

According to recommendations of the American College of Sports Medicine and the American Heart Association (NELSON et al., 2007), each training sessions was divided into four main parts: Warm-up (5-10 minutes, low-intensity exercises for major muscle masses in combination with dynamic balance (ROSE D. J., 2003), specific training (20 - 25 minutes, including upper and lower body resistance training with progressively increased loads), aerobic training (10-15 min, including balance, agility and gait) and cool down (5 minutes with respiratory and flexibility exercises). In the first 2 weeks, exercises were performed using the body loads (CADORE et al., 2014) to ensure an appropriate adaptation to resistance exercise and allow all participants to complete the whole set of repetitions. The weight progression was increased every 2 weeks, the participants started with the body weight and after 2 weeks it was increased 1kg peer time. The increase of 1kg was done when the RPE presented lower values than the last session (Table 5.1) the increase of the weight was done when the RPE values decrease 2 points in the scale. The muscle-

strengthening exercises were selected to work all the muscles that were related to the basic everyday life activities (e.g., walking, climbing stairs among others). The exercises were standing abduction, standing knee flexion, sitting knee extension, sitting arm curling, sitting shoulder extension, squats and push press (APPENDIX IX and APPENDIX X).

Due to the frail condition of the participants and for safety reasons, sessions were mainly chair-based and routines of functional exercises with low coordination requirements were emphasized so participants could achieve the session's goals. The heart rate (HR) and the RPE were monitored in 2 moments during the training session, at the end of the strength exercises and at the end of the aerobic training part. These variables were measured to control the intensity of the training. The HR resting was measured in the first week of the training program, with older adults sitting in a quite place and in silence during 5 min. HR max (220- age) was calculated in order to see the percentage zone that the older adults maintained in the training period.

Table 3.1 Description of training progress.

WEEKS	SETS	REPETITIONS	LOAD	INTENSITY
1 and 2	1	15	Body load	Low speed
3 and 4	1	15	Increase load considering RPE decrease	Low speed
5 and 6	2	15	Increase load considering RPE decrease crease load	Low speed
7 and 8	1	15	Increase load considering RPE decrease	Fast speed in concentric phase and low speed in excentric phase
9 and 10	2	8-10	Increase load considering RPE decrease	Fast speed in concentric phase and low speed in excentric phase
11 and 13	3	8-10	Increase load considering RPE decrease	Fast speed in concentric phase and low speed in excentric phase

Statistical analysis

The SPSS Statistical Software package (version 17.0) was used to analyze all data. Descriptive analyses consisting of frequencies, means ± standard deviations, and mean differences were performed, followed by the Shapiro–Wilk and Levene's tests to identify the normal distribution and homogeneity parameters, respectively. Participants' characteristics groups were checked through one-way ANOVA. Only the Six Minute Walk Test was different at PRE values, thus the ANCOVA was performed using the PRE instant as a covariant. The training related effects were assessed using mixed-model ANOVA having training (multi-component and control group) and time (pre and post training measurements) as fixed factors. The RPE arm curling in constant-load test was calculated separately with older women in order to see the effects of training in this variable. Where significant group x time interactions were found, a Tukey post-hoc test was used to determine where differences occurred. In addition, where main time effect was significant, the effect size was calculated and determined based on Cohen's *d* for paired comparisons, pre and post-training group measurements to all the variables. The effect size values of references were: (> -0.2) trivial; (> 0.2) small; (>0.5) moderate and (>0.8) large effect. Partial eta squared (n^2_p) was determined when time and training interactions occurred (NAKAGAWA; CUTHILL, 2007), values of references smal (>0.10), medium (>0.25) and large (>0.40). Statistical significance was accepted when $p<0.05$.

Descriptive analyses consisting of frequencies, means ± standard deviations, and mean differences were performed between ADL and IADL questionnaires and

RPE in constant-load responses in order to verify the improvements in each variable.

5.3 Results

The physical characteristics of participants are summarized in Table 5.2. There were no differences in physical characteristics between two groups at baseline time (p>0.05; see Table 5.2). The sample majority presented some dementia (46% in the CG; 61% in the MCT group), the low scores on the MMS confirmed such affirmation (12.55 ± 3.77 and 16.92 ± 6.42, respectively). Participants in the MCT group attended 77% of the exercise sessions (19.69 ± 6.21 sessions). The average RPE and heart rate during strength exercises of the multicomponent training was 13 ± 3 RPE and 63% of the HR max. During the aerobic exercises of multicomponent training, the average RPE was 13 ± 3 RPE and HR was 65% of the HR max.

Table 5.2 Participants Characteristics (Mean ± Standard Deviation)

	Experimental Group (n=13)	Control Group (n=12)	p<0.05
Age (years)	69.2±7.4	72.4±8.9	0.55
Height (cm)	66.9±16.6	67.4±15.4	0.94
Weight (kg)	155.6±11.6	155.1±8.8	0.27
BMI (kg/m^2)	28.0±6.1	27.9±5.5	0.92
Mini Mental State*	16.9±6.4	12.5±3.8	0.53

*MMS scores ≤20 indicate cognitive impairment

Functional capacity

The functional outcomes are presented in Figure 5.2. After training, there was a time vs. group interaction in sit to stand test ($F_{(1,25)}$ = 4.26; *P* = 0.05), arm curling

($F_{(1,25)}$ = 5.64; *P* = 0.02) and arms flexibility tests ($F_{(1,25)}$ = 4.38; *P* = 0.04). There was a significant decrease in the time of sit to stand test in MCT group (PRE 22.16±3.15 s; POST 13.53±1.18 s, *P* =0.00; 27%, n^2_p=0.30, observed power = 0.84), whereas no changes were observed in control group (PRE 19.15±3.28 s; POST 18.84±1.23 s, *P* =0.91; 2%, n^2_p=0.00, observed power = 0.05). The MCT group improved significantly the repetitions in arm-curling test (PRE 11.38 ±0.936 repetitions; POST 15 ±1.17 repetitions, *P* =0.00; 31%, n^2_p=0.32, observed power = 0.89), whereas no changes were observed in control group (PRE 12.08 ±0.97 repetitions; POST 12 ±1.22 repetitions, *P* =0.94; 0.6%, n^2_p=0.00, observed power = 0.05). There was a significant increase in arms flexibility in MCT group (PRE -32.8±4.2 cm; POST -22.2±4.5 cm, *P* =0.00; 32%, n^2_p=0.36, observed power = 0.93), whereas no change was observed in control group (PRE -32.9±11 cm; POST -30.9±11 cm, *P* =0.58; 5%, n^2_p=0.01, observed power = 0.08).

In addition, there was a time vs. group interaction to Berg Balance Test ($F_{(1,25)}$ = 4.88; *P* = 0.03) (Figure 5.3). The MCT group improved significantly the score in berg balance (PRE 43 ±3.72 score; POST 51.38 ±2.18 score, *P* =0.00; 15%, n^2_p=0.27, observed power = 0.80), whereas no change was observed in control group (PRE 43 ±3.8 score; POST 42.9 ±2.2 score, *P* =0.80; 2%, observed power = 0.05). In constrast, there were no time and group interaction and main time effect changes in lower flexibility, TUG, 6 minutes walking and 4 meters walking in all groups.

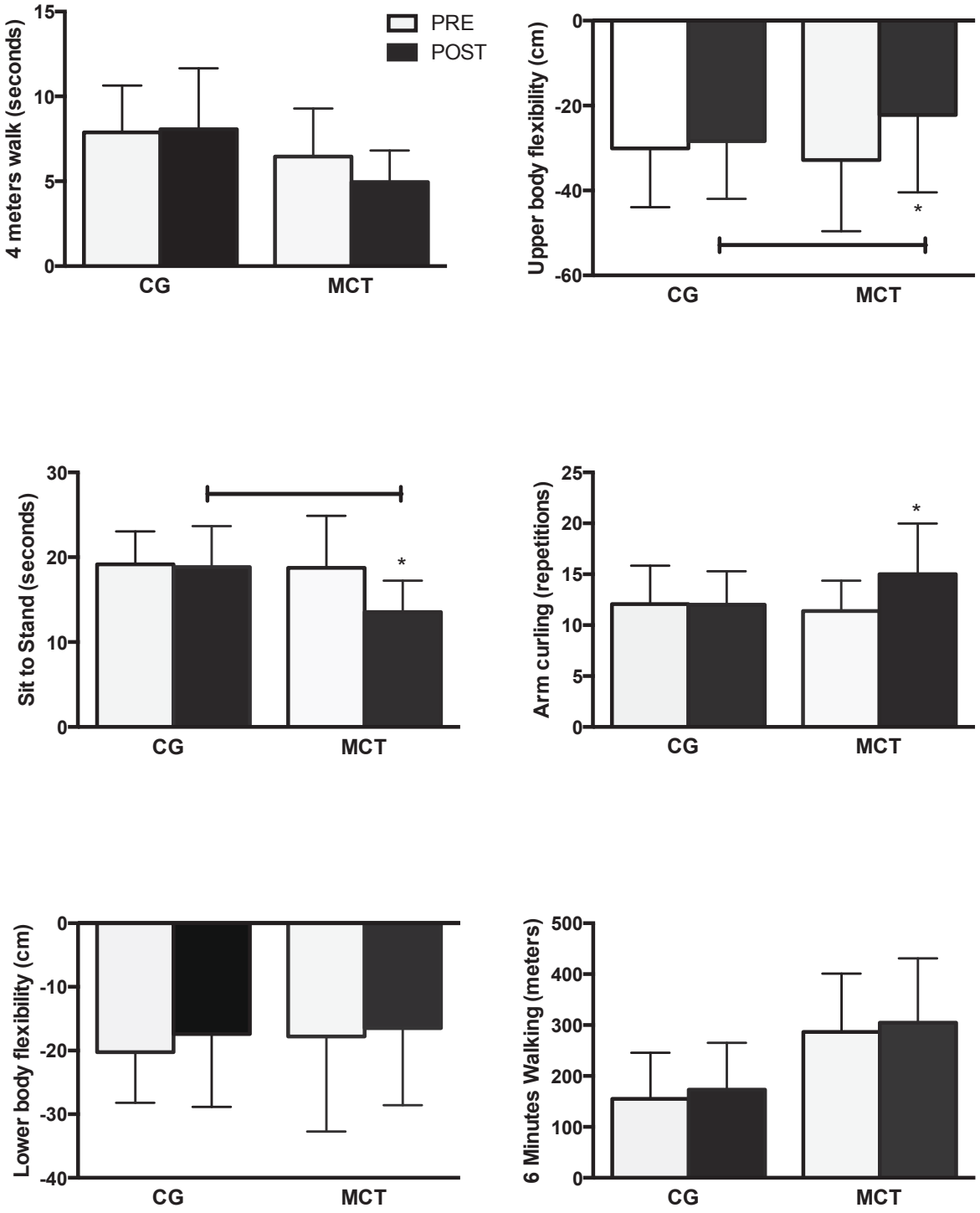

Figure 5.2 Mean and SD of Lower and upper body flexibility, arm curling, sit to stand and 4 meters walking. *Significantly different from pretest instant. The horizontal line presents significant difference between MCT and CG groups at post-test. CG, control group; MCT, multicomponent group; SD, standard deviation.

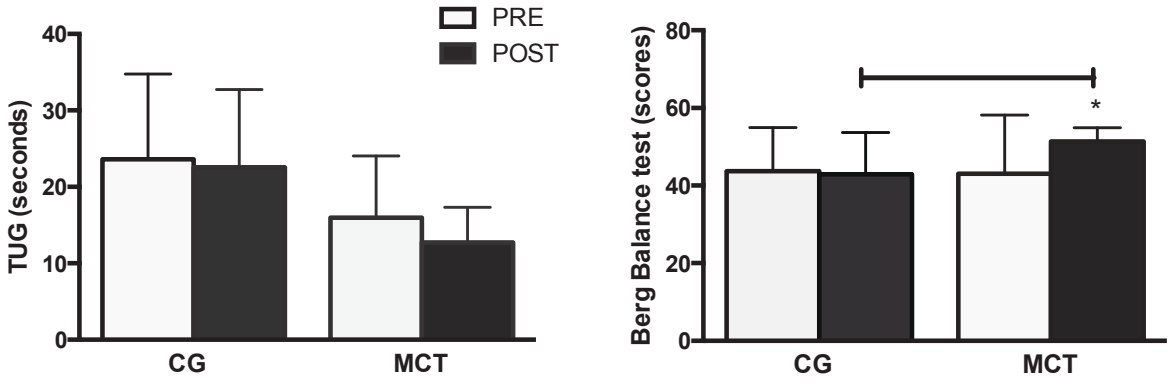

Figure 5.3 Mean and SD of TUG and Berg balance test. *Significantly different from pretest instant. The horizontal line presents significant difference between MCT and CG groups at post-test. CG, control group; MCT, multicomponent group; SD, standard deviation.

Perceived Exertion

The rating of perceived exertion are presented in the Figure 5.4. There was a time vs. group interaction to RPE sit to stand test ($F_{(1,25)}$ = 6.42; *P* = 0.02). The MCT group improved significantly the response in RPE sit to stand (PRE 12.6 ±2.8 RPE; POST 10.3±2 RPE, *P* =0.001; 19%, n^2_p=0.37, observed power = 0.93), whereas no change was observed in control group (PRE 13.8±3.6 RPE; POST 13.2±2.6 RPE; *P* =1.00, 4%, observed power = 0.05). However, there was no significant time and group interaction and main time effect in perceived exertion arm-curling in constant-load test for the control (PRE 14.8±3.5 RPE; POST 14.4±2.4 RPE; 95%CI=12.9-16.9; *P* =.514, 2%, observed power = 0.09) and multicomponent groups (PRE 13.3±3.3 RPE; POST 12±2.2 RPE; 95%CI=11.4-15.3; *P* =.514, 9%, observed power = 0.09) (Table 5.4).

In addition, RPE arm-curling was analyzed separated to the older women, once only the older women presented concurrent validity in the first study of this thesis. There was a main time effect in perceived exertion arm-curling constant test

($F_{(1,16)}$=5.12; *P* =0.040), MCT group presented a larger effect size (PRE 15 ±2.6 RPE; POST 12 ±2.8 RPE; 20%, Cohen's d=1.08, observed power = 0.78) than control group (PRE 14.2 ±3.5 RPE; POST 14 ±2.7 RPE; 1.7%, Cohen's d=0.07, observed power = 0.05) (Table 5.3, Table 5.5 and Table 5.6).

Table 5.3 The value of the RPE arm-curling constant-load test for each participant in the control and multicomponent group and the improvements after training. D = independence to dependence after training; I = dependence to independence after training.

	RPE arm-curling pre	RPE arm-curling post	Change POST
CONTROL GROUP	19	16	
	9	11	
	11	15	D
	11	13	D
	17	19	
	17	17	
	11	15	D
	15	13	
	19	12	I
	15	12	I
	16	13	
	18	17	
MULTICOMPONENT GROUP	11	10	
	15	11	I
	15	11	I
	17	17	
	17	15	
	11	11	
	13	8	I
	13	9	I
	13	9	I
	15	12	I
	19	13	
	11	13	D
	13	9	I

Table 5.4 The value of the RPE sit to stand constant-load test for each participant in the control and multicomponent group and the improvements after training. D = independence to dependence after training; I = dependence to independence after training.

	RPE sit to stand pre	RPE sit to stand post	Change POST
CONTROL GROUP	13	13	
	20	20	
	10	12	D
	11	11	
	15	15	
	17	13	
	10	11	D
	20	20	
	11	10	I
	13	15	
	11	13	
	15	13	
MULTICOMPONENT GROUP	11	9	I
	13	8	I
	9	11	D
	18	13	
	13	13	
	13	9	I
	11	7	I
	11	11	
	11	8	I
	19	11	
	10	10	
	13	13	
	13	11	

Table 5.5 The value of the basic activities of daily living (ADL) questionnaires for each participant in the control and multicomponent group and the improvements after training. D = independence to dependence after training; I = dependence to independence after training.

	ADL PRE	ADL POST	Change POST
CONTROL GROUP	6	5	
	2	0	
	4	3	
	6	6	
	5	2	D
	5	5	
	6	6	
	1	0	
	3	0	D
	5	5	
	6	6	
	5	4	D
MULTICOMPONENT GROUP	6	6	
	6	6	
	6	6	
	6	6	
	3	5	I
	6	5	
	5	6	
	6	6	
	6	5	
	5	4	D
	4	6	I
	5	5	
	5	6	

Table 5.6 The value of the instrumental activities of daily living (IADL) questionnaires for each participant in the control and multicomponent group and the improvements after training. D = independence to dependence after training; I = dependence to independence after training.

	IADL PRE	IADL POST	Change POST
CONTROL GROUP	7	9	
	7	7	
	7	9	
	11	7	
	7	7	
	9	10	
	7	7	
	12	0	D
	7	7	
	7	7	
	21	8	D
	20	8	D
MULTICOMPONENT GROUP	9	14	
	8	14	
	12	11	
	7	9	
	7	8	
	8	7	
	14	8	
	9	11	
	8	7	
	7	8	
	7	7	
	7	8	
	11	10	

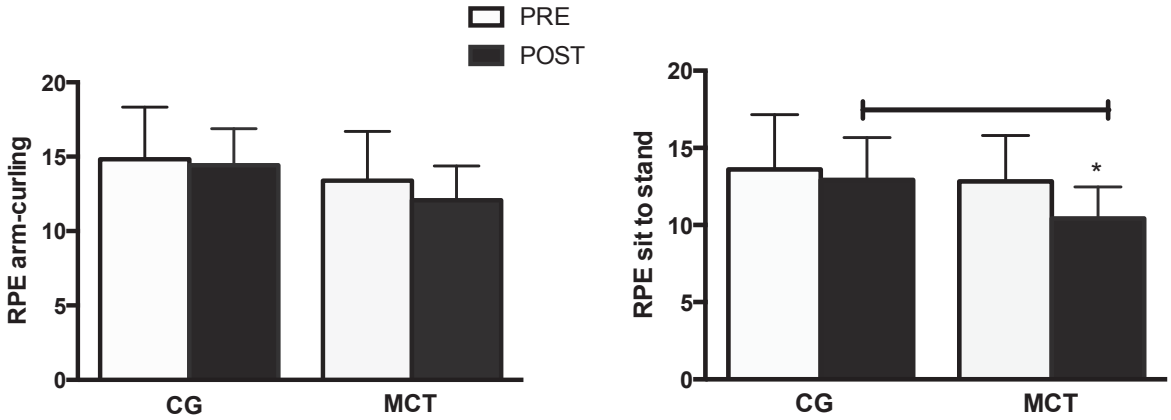

Figure 5.4 Mean and SD of RPE arm-curling and sit to stand tests with the older adults. *Significantly different from pretest instant. The horizontal line presents significant difference between MCT and CG groups at post-test. CG, control group; MCT, multicomponent training group; SD, standard deviation.

Questionnaires

In the Katz questionnaire the average of the control group decreased the ADL independence in the POST-test (3 older adults decrease (25%) and 9 maintain the same (75%)) and in the MCT group increased the ADL independence in the POST-test (2 older adults increase (15%), 1 decrease (7%) and 10 maintain the same (76%)). In the Lawton questionnaire (Table 5.7), the control group decrease the IADL independence in the POST-test (2 older adults decrease (16%) and 10 maintain the same (83%)) and the MCT group everyone maintain the same score in the POST-test (PRE 8.76±2.24 score; POST 9.4±2.5 score).

In RPE constant-load tests responses, control group increase the responses in RPE arm-curling in constant load test, 6 older adults increase (50%), 4 decrease (33%) and 3 maintain the same response (25%) and in MCT group decrease the responses in RPE, 10 older adults decrease (76%), 1 increase (7%) and 2 maintain

the same response (15%) (Table 5.7). In RPE sit to stand the control group increase RPE responses, 5 older adults increase (41%), 3 decrease (25%) and 5 maintain the same (41%) and in MCT group the RPE sit to stand presented a decrease in RPE responses, 8 older adult decrease (61%), 1 increase (7%) and 4 maintain the same (30%).

Table 5.7 Descriptive analyses of participants value of the RPE, ADL and IADL in the control group (CG) and multicomponent training group (MCT) (Mean ±Standard Deviation).

	CG		MCT	
	PRE	POST	PRE	POST
ADL	4.5±1.6	3.5±2.4	5.3±1	5.5±0.6
IADL	10.1±5.1	7.1±2.4	8.7±2.2	9.3±2.4
RPE arm-curling	14.8±3.4	14.4±2.4	14±2.5	11.3±2.5
RPE sit to stand	13.8±3.6	13.2±2.6	12.6±2.8	10.3±2

5.4 Discussion

The aim of this study was to verify the sensitivity of RPE in constant-load tests to differentiate dependence in performing self-care activities improvements after a period of multicomponent training in institutionalized older adults. The main finding was that the RPE in constant-load tests presented capacity to be sensitivity to differentiate improvements in the level dependence in performing activities of daily living, once RPE responses were lower after multicomponent training in institutionalized older adults. An important finding was that institutionalized older adults presented more improvements in dependence in performing activities of daily living considering the lower reponses RPE in constant-load tests values after training.

Older adults improved performance-based tests (arm curling, 5 times sit to stand and arms flexibility) and Berg balance test after multicomponent training. The positive effects of exercise on functional capacity can be observed when two or more physical conditioning components (i.e., strength, endurance or balance) are included in exercise intervention (CADORE et al., 2014). Our results are in agreement with previous studies that investigated the effects of multicomponent exercise interventions in institutionalized older adults (CADORE et al., 2014; JUSTINE et al., 2012; SAMPAIO et al., 2016; SCARABOTTOLO et al., 2017). The higher level of sedentary behavior and the majority of dependence in performing self-care activities have been found in the instituionalized place, making studies that focus in this population very important. Maintenance of a mobility good level, tightly related to independence in ADL and IADL (DIRIK; CAVLAK; AKDAG, 2006; FAGERSTRÖM; BORGLIN, 2010), should be a priority for older adults living in residential care facilities. Acoording to the present study results; older adults had presented improvements in activities of daily living. However, the older adults had not improved the time up and go test, 6 minutes walking, 4 meters walking and lower flexibility. The MCT could be not significative to improve these variables, once the training focused in just 10 min of cardiovascular training and not in the flexibility improvements. Another reason could be the older adults charactheristic, as the majority of older adults presented some dementia and not performed the exercise in their best performance. For this type of population a training that last longer than 13 weeks may be more interesting. Binder et al. (2002) showed significant improvements in physical performance scores in older adults after 36 weeks of multicomponent training intervention (BINDER et al., 2002). Therefore, the 13 weeks of training in the present study can be a cause of no improvements in all the performance-based tests,

once longer training duration had been more effective (BRACH et al., 2002; LOPES et al., 2016). After the improvements in performance-based tests, multicomponent training was effective to improve functional capacity in institutionalized older adults.

The RPE in constant-load sit to stand test showed a lower score in multicomponent training group than control group after the period of training. These results can confirm the indicative relationship between dependence in performing activities of daily living and RPE reported in Chapter 4. The hyphoteses were that older adults that improve the autonomy in performing self-care activities and physical capacity after training report a lower RPE, once RPE is related to the fatigability that older adults fell during the exercise (LUIGI et al., 2001; ROBERTSON; NOBLE, 1997). This means that older adults had experienced less fatigability after a period of multicomponent training in sit to stand constant-load test. Perceived exertion is a subjective perception where exercises report their body's effort during the exercise (BORG, 1974). Therefore, after the training period older adults recalibrated their perception of "usual effort" improving strength, agility and flexibility through multicomponent training. Moreover, older adults, who improved their basic and instrumental activities of daily living, had experienced less difficulty in perceived exertion in constant-load test. The decline in physical fitness is often progressive during the aging process, however after the training program the increase of physical fitness makes them less tiredness in performing the test, having as a result lower RPE responses and a perceiving of lower effort.

The results shown that older adults who reported some exertion in RPE sit to stand in constant-load test in the PRE instant had felt less exertion after multicomponent training. Although, in RPE arm curling in constant-load test older adults perceived the same exertion in the PRE and POST instant. The training

session was focused in the upper and lower strength. Greater reductions in arm strength has been induced by the long care facilities. The most daily living activities is performed with the arms and they performed less activites living in institutionalized places (LEVEILLE; RESNICK; BALFOUR, 2000). After the period of training, it was possible to find a improvements of 30% in the arm-curling test, considering that the training was effective to increase the strength in the arms. However, the RPE arm-curling did not present improvements after training. These resuts may be affected by the chaacteristic of the load in the RPE arm-curling test that can induce a higher perceived exertion in the older adults, due to their weakness and the influence on the psychological perception, perceiving more exertion when load has been carried on.

The RPE arm-curling in constant-load test was not significantly after training when all the older adults (men and women) had been compared. Furthermore, as seeing in the Chapter 4, the RPE arm-curling in constant-load test was only concurrent validity with older women. Therefore, after the training program, another analyse had been done only with older women. In these analyses, RPE arm-curling presented a lower RPE responses in multicomponent group than control group. When the analyse was done with all older adults, the improvements in older women was not strong enough to presented the effects of training, once men did not presented a concurrent validity to RPE arm-curling test. The older men could felt less fatigability in arms before multicomponent training, despite the training did not cause large improvements in arms for older men (GILL; WILLIAMS; TINETTI, 1995). The older women physical fitness characheristics showed more improvements after the training program in order to verified increases in the RPE arm-curling test. However, it is necessary before verify the sensitivity confirm the concurrent validity of older men in RPE arm-curling with another instrument to use as a criterion. Once the

questionnaire was not the best evaluation to detect dependence in performing self-care activitites in older men. This evaluation is worsed to apply in institutionalized older adults, as they did fewer activities in daily living than community older adults. In addition, RPE arm-curling in constant-load test could be a tool to differentiate dependence in performing self-care activities in older women after a period of multicomponent training.

The responses in questionnaires presented difficults to find improvements in dependence level in performing self-care activities after training in both groups than the RPE in contsnta-load tests. The majority after training analyses has been related to the maintainance or reduction of the dependence level in performing self-care activities. However, RPE responses in constant-load tests presented more improvements after training in multicomponent group than control group. This result showed that RPE in constant-load tests have ability to evaluate the improvements after training more pronounced than questionnaires. As mentioned before the older adults have more facility to perceived less fatigability in a constant-load test than perceived less in a test that has intensity variability. The physical fitness and health status of older adults affected more the perceived exertion than the aging alone (GROSLAMBERT; MAHON, 2006). After a period of training is possible to verify RPE in constant-load tests improvements, however it is more difficult to confirm these improvements in self-care activities reported by questionnaires. The RPE in constant-load tests could be a good indicator to verify the training effects. The hypotheses that older adults with a high physical capacity in activities of daily living present a better RPE was confirmed, once older adults in multicomponent training group presented lower RPE responses.

The present study found increases in performance-based tests, ADL independence and RPE responses in constant-load tests after a period of training, considering these improvements it was possible to revert functional fitness decline with multicomponent training. However, the population characteristics may have influenced the results. The older adults characteristic of dementia make difficulties in performing exercise training (YU; DEMOREST; VOCK, 2015) and reporting the RPE in constant-load tests. Dawes et al. (2005) investigated the Borg 6-20 scale ratings varied by participants with brain injury, chronic lower back pain, and healthy ones (DAWES et al., 2005). They found that RPE responses by healthy controls, brain injury and chronic lower back pain groups were similar; however, the brain injury group had more variance in their understanding of the verbal anchors in scale (DAWES et al., 2005). In the present study, the RPE in constant-load tests could be affected by dementia of some participants. Findings suggest that cognitive impairment likely reduces a person's ability to adequately interpret their physiological signals and report a valid RPE. Although, Yu (2015) presented a lower correlation between the RPE responses and physiological variable (YU; DEMOREST; VOCK, 2015; ATHERTON et al., 2016) and some studies found a low correlation between heart rate and perceived exertion in older adults with Alzheimer (YU; BIL, 2010; YU; DEMOREST; VOCK, 2015), showing a relationship between these variables despite low. The relantioship between RPE and physiological variables in older adults with dementia was confirmed in previuos studies, thus it can be an indicator that RPE is a good tool to apply in older adults with and without dementia. Besides the limitation of the participant's dementia, the present study presented evaluation restriction in the institutional place. Once the older men did not present concurrent validity in RPE arm-curling in constant-load tests, it was thought not to include them in the study.

However, due to an ethical issue, it was impossible to exclude older men from training program. Although, older adults without dementia could perform better RPE in constant-load tests and can presented a correlation more pronounced with dependence in performing self-care activities.

According to the literature, exercise can produce short-term, highly improvements even in frailer older adults (FIATARONE et al., 1994) and older adults with dementia (SAMPAIO et al., 2016). This affirmation is confirmed in the present study showing improvements in performance-based test and RPE in constant-load tests. The MCT program can be able to prevent the functional capacity decline and improves the responses in RPE values. The number of older adults that live in an institutionalized place have been growing up; moreover a large proportion present some dementia (LUPPA et al., 2012). A small number of studies assessed older adults that live in a nursing home (CADORE et al., 2014; IZQUIERDO; CADORE, 2014; SAMPAIO et al., 2016). More studies that evaluate this population are necessary to develop. The exercise systematic prescription is crucial to prevent increase of dependence in performing self-care activities. Healthcare professionals that work in a institutionalized place need to know what type of exercise and instrument are more effective to improve dependence in performing self-care activities in order to better attendance of this population. However, future researches with older adults that live in institutionalized place with some dementia and older adults that live in the community are necessary.

RPE in constant-load tests should be consider a instrument to differentiate dependence in performing self-care activities in institutionalized older adults after a period of training. Thus, the present study results could consider the RPE in constant-load tests to verify the dependence in performing ADL and IADLS

improvements after a period of training and to evaluate the physical functioning levels improvements. In addition, the present study found sensitivity of RPE in constant-load tests to differentiate dependence in performing self-care activities after training in older adults.

5.5 Conclusion

In conclusion, rating of perceived exertion of sit to stand and arm-curling in constant load tests can be sensitivite to differentiate dependence level in performig self-care activities after a period of multicomponent training in institutionalized older adults. Older adults perceived lower RPE in constant-load tests after a period of training and consequently presented more improvements in dependence level in performing daily living activities than the questionnaires. The RPE in constant-load test can be used to evaluate the training effects on dependence level in performing self-care activities after a training program in institutionalized older adults.

CHAPTER 6

General discussion, conclusions and recommendation for future studies

6.1 General discussion

The present thesis aimed to verify concurrent validity, reliability and sensitivity of the perceived exertion to differentiate dependence in performing activities of daily living in older adults. To answer these aim, two studies were performed in which the first one, described in chapter 4, focused on the following experimental aim:

1. To verify the ability of perceived exertion in constant-load tests to differentiate dependence in performing activities of daily living in older adults.

The research hypothesis to the first experimental aim was:

1. The perceived exertion in constant-load tests presents concurrent validity and reliability to differentiate dependence in performing activities of daily living in older adults.

In fact, the perceived exertion in constant-load tests presented concurrent validity with the questionnaires that predicted the dependence level in performing self-care activities as a criterion, but to older men the test was not efficient. However, RPE arm-curling test presented concurrent validity just for older women and RPE sit to stand presented concurrent validity for older men and women. The RPE in constant-load tests had shown a higher reliability of testing days, thus the instrument presents effectiveness accuracy. RPE in constant-load tests presented diagnostic accuracy to differentiate dependence in performing self-care activities in older adults, showing the cut-off point 13 RPE to arm-curling test and 11 RPE to sit to stand test. Therefore, older adults that reported more than the cutoff points in the respectively test presented dependence in performing self-care activities.

Moreover, the first research hypothesis was partially accepted, once the association between perceived exertion and dependence in performing daily living activities in older adults was confirmed, despite older men presented not too strong association. Furthermore, the older men received a low score in the questionnaires and presented a higher score in the RPE constant-load tests, this means that the criterion variable that had been used present some limitation. The questionnaires did not precisely evaluate the dependence in performing self-care activities in older men.. Another point that needs to be highlighted was the small number of older men that cannot confirm the concurrent validity and apply to all population. However, the association between RPE in constant-load tests and dependence in performing self-care activities was confirmed, demonstrating that older adults with a decrease in dependence in performing self-care activities reported higher values in perceived exertion constant-load tests.

The RPE in constant-load tests can serve as another option to the healthcare professionals that work with older adults, once the instrument can control the test intensity and consequently can reduce the motivation influence. To evaluate dependence in performing self-care activities are necessary, once the diagnostic of dependence is crucial to revert and prevent the reduction of quality of life (GURALNIK; FERRUCCI, 2003). The data collection had been done in a BHU in order to achieve a large number of older adults, thus a place that the older adults are more concentrated could be more indicated to present pronounced results. However, these means that the RPE in constant-load tests is easy to take for everywhere and to apply for all population that is a good characteristic for a test to evaluate dependence in performing self-care activities in older adults. It is easier to older adults perceive less fatigability in a constant-load test than to perceive a decline in

dependence level in performing the day-by-day activities (LUIGI et al., 2001; ROBERTSON; NOBLE, 1997), once in the questionnaires the older adults could lie and not rememeber the capacity to perform determine task. This is a good tool to evaluate the dependence, once older adults will answer correctly the real dependence. Unfortunetly, the present study had not have a mini mental cutoff point, due to older adults that attend the BHU presented less level of education, thus it can be considered a limitation of the present study. Though, the RPE in constant-load test confirmed their concurrent validity and high reliability and can be considered an alternative to differentiate dependence in performing self-care activities in older adults.

Since the perceived exertion in constant-load tests used on chapter 4 was able to confirm the concurrent validity and reliability, it was used RPE in constant-load tests to differentiate dependence in performing self-care activities in older adults. It was necessary to verify if RPE in constant-load tests had sensitivity to differentiate the older adults after a training period. Subsequently, chapter 5 addressed on the following experimental aim:

2. To verify the sensitivity of perceived exertion in constant-load tests to differentiate dependence in performing self-care activities after a period of multicomponent training in older adults.

The research hypothesis to the second experimental aim was:

2. The perceived exertion in constant-load tests presents sensitivity to differentiate dependence in performing self-care activities after a period of multicomponent training program in institutionalized older adults.

The hypothesis of this study was accepted, once perceived exertion in constant-load tests presented sensitivite to differentiate dependence in performing self-care activities after multicomponent training in institutionalized older adults. However, RPE arm curling presented sensitivity just in older women and RPE sit to stand presented in older adults of both genders. These means that older adults in the multicomponent training reported lower RPE in constant-load tests responses after training than control group. Many studies have focused in a training program in order to verify the improvements in functional capacity in older adults (BINDER et al., 2002; CADORE et al., 2014; KENNY et al., 2010; NELSON et al., 2007). However, there is a lack of instruments that evaluate dependence in performing self-care activities after training. It is crucial to confirm the sensitivity of RPE in constant-load tests to evaluate dependence in performing self-care activities after training, once this instrument can be more sensitivity to verify the effects of training. The RPE in constant-load tests have been correlated to the physical fitness level, thus the improvements in one physical fitness variable in the training program can affect the RPE responses. Finally, the RPE responses in the multicomponent training group presented lower values compared to the control group, confirming this hypothese. The correct evaluation of the training effects is very important to confirm the benefits of training program and consequently verify the test sensitivity. The RPE in constant-load tests presented a capacity to verify the improvements in dependence level in performing daily living activities in institutionalized older adults.

The institutionalized older adults have a low level of physical activity and spend their time in sedentary behaviors; consequently it has been connected to lower level of dependence in performing self-care activities (HARPER ICE, 2002). These highlight the importance of more studies with institutionalized older adults, once they

are more impaired than their counterparts. However, the majority of older adults that lives in nursing home present some dementia. The older adults without dementia could have better results in the RPE in constant-load tests improvements and could performed better the exercises participating more constantly in the exercise program. However, the multicomponent training was effective to provide improvements after training in performance-based tests and in RPE constant-load tests, confirming the association between RPE responses and the physical fitness improvements after training. After the training period is easier to older adults fell less effort performing the same test and load as the training begging than actually improving the scores performing the test faster. The majority of professional who prescribe exercise program to institutionalized older adults do not know exactly how they can work with them. Thus, it is possible to highlight the importance of the present study in order to validate a test to evaluate the effects of training program and a training program that produced improvements in this population. Interventions that reduce the caregiver burden should be in a position of effectively change the institutionalization process. The RPE in constant-load tests can be considered an alternative to measure the training effects in institutionalized older adults. Finally, the RPE constant-load tests presented sensitivity to differentiate dependence in performing self-care activities after a period of multicomponent training in institutionalized older adults.

6.2 General conclusions

The RPE sit to stand and arm-curling in constant-load tests presented concurrent validity though the low correlation, a good reliability and capacity to diagnostic the dependence level in performing self-care activites (sensitivity) in older adults, despite the RPE in constant-load testes did not present a good capacity to differentiate level of dependence in older men. The cutoff point to detect the diagnostic accuracy of RPE in the arm curling was 13 RPE in older women and in sit to stand was 11 RPE in older adults. The perceived exertion sit to stand and arm-curling constant load tests presented sensitivity to differentiate dependence level in performing self-care activities after a period of multicomponent training in institutionalized older adults. Confirming the hypotheses that the older adults who reported lower RPE in the posttest improve the dependence level in performing activities of daily living. The RPE in constant-load test may be used as another option to differentiate dependence level in performing self-care activities in older adults.

6.3 Recommendation for future studies

Future study regarding the concurrent validity with a large number of older men is recommended. It is also important that future studies should consider the evaluation of the physiological variables (lactate, heart rate, electromyography among others) during the RPE in constant-load tests to verify if these variables have the same responses as the RPE values. To the future studies is important to verify a cut off point in the Mini Mental state in order to control the cognition of the older adults. In

addition, studies that involve community older adults and the RPE in constant-load tests to assess the dependence in performing self-care activities after the training program are also substantial to analyse. Finally, future studies need to consider another test to use as criterion to perform the concurrent validity, once the questionnaire of dependence level in performing self-care activities presented some limitations to diasgnotic the level of dependence.

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APPENDIX I – CONSENT FORM OF CHAPTER 4

Por favor, leia com atenção as informações contidas abaixo antes de dar o seu consentimento para participar deste estudo.

Nós, ANDRE L.F. RODACKI, PAULO C.B. BENTO, GLEBER PEREIRA, ANNA R.S. GOMES, MATEUS C. SILVEIRA, NATÁLIA B. MOREIRA, RENATA WOLF, PAULA B. LOPES e JARBAS M. FILHO, pesquisadores da Universidade Federal do Paraná, estamos convidando idosos com idade igual ou superior a 60 anos, de ambos os sexos, residentes no município de Curitiba, a participar do estudo intitulado "RISCO DE QUEDAS EM IDOSOS: ASSOCIAÇÃO ENTRE ASPECTOS COGNITIVOS, CLÍNICOS E FUNCIONAIS". Lembrando, que é por meio das pesquisas que ocorrem os avanços importantes em todas as áreas, e sua participação é fundamental.

a) O objetivo desta pesquisa é verificar a associação entre o estado cognitivo, condição clínica, percepção do risco de quedas, fatores residenciais relacionados ao risco de quedas, nível de atividade física, perfil antropométrico e funcionalidade com episódios de quedas em idosos de Curitiba – Paraná.

b) Caso o(a) Sr.(a) participe da pesquisa, será necessário realizar uma avaliação em forma de entrevista face a face sobre: informações sociodemográficas (estado civil, escolaridade e nível econômico), cognição (memória e atenção), quedas (quantidade e local de quedas nos últimos meses), equilíbrio (atividades realizadas em seu dia-a-dia), nível de atividade física (atividades físicas realizadas por semana), fatores residenciais relacionados ao risco de quedas, percepção subjetivo do esforço (sensação de cansaço) e capacidade funcional (perguntas relacionadas ao seu dia-a-dia). Além disso, será necessário que o Sr.(a) realize uma bateria de testes para avaliação da funcionalidade (testes: velocidade de caminhada, força de preensão manual, sentar e levantar; sentar e alcançar; alcançar atrás das costas; flexão de antebraço, caminhar durante 6 minutos; caminhar por 3 metros; equilíbrio geral e equilíbrio relacionado ao sistema vestibular). O tempo gasto previsto da avaliação será de 2h, sendo que toda a coleta de dados será realizada em horário previamente agendado com a Unidade Básica de Saúde ou Centro de Atividade Física mais próximo a sua casa, não necessitando que o(a) Sr.(a) compareça em outro local.

c) Para tanto o Sr.(a) deverá comparecer na Unidade de Saúde ou Centro de Atividade Física mais próximo a sua casa, para realização das avaliações (questionários e testes).

d) Quando convidado, deverá receber na sua residência um componente da equipe para avaliação domiciliar dos fatores de risco para quedas, com data e hora previamente marcadas.

e) É possível que o(a) Sr.(a) experimente algum desconforto, principalmente relacionado a dor muscular leve decorrentes dos movimentos solicitados em cada teste.

f) Alguns riscos relacionados ao estudo podem ocorrer, como: constrangimento ao idoso, contudo, para minimizar tais efeitos a entrevista será realizada de maneira individualizada por pesquisadores previamente treinados. Além disso, o(a) Sr.(a) poderá sentir dores musculares leves durante ou logo após a realização dos testes funcionais. No entanto, esses desconfortos não duram por muito tempo, desaparecendo logo nas 24 seguintes ao exercício. Lembrando, que os testes serão realizados em forma de circuito com o intuito de minimizar os efeitos da fadiga localizada, dor e desempenho dos idosos. O intervalo de recuperação entre os testes será de aproximadamente 2 minutos, e os idosos podem interromper os testes a qualquer momento.

g) Os benefícios esperados com essa pesquisa são: Os idosos terão a oportunidade de verificar seu nível cognitivo, condição clínica, funcionalidade, e risco de quedas. Com esses resultados os idosos poderão se conscientizar sobre seu estado geral de saúde, prevenindo a ocorrência e/ou reincidência de quedas, promovendo um envelhecimento saudável e com qualidade de vida. A avaliação aplicada nos

idosos acrescentará conhecimento aos pesquisadores e as autoridades públicas do município de Curitiba – PR por meio da atividade proposta, de forma a identificar o nível cognitivo, condição clínica, funcionalidade, e risco de quedas dos participantes, com o intuito de incentivar e proporcionar estratégias benéficas para o cuidado ao idoso.

h) Os pesquisadores, ANDRE L.F. RODACKI (41) 9129-8595, PAULO C.B. BENTO (41) 9966-6196, GLEBER PEREIRA (41) 9999-8555, ANNA R.S. GOMES (41) 3360-4322 do Departamento de Educação Física da Universidade Federal do Paraná, e seus doutorandos MATEUS C. SILVEIRA (55) 9657-1713, NATÁLIA B. MOREIRA (41) 9880-1882, RENATA WOLF (41) 9634-9583, PAULA B. LOPES (41) 9183-6040 e JARBAS M. FILHO (41) 9725-9493, lhe assegurarão a assistência durante toda pesquisa, bem como para esclarecer eventuais dúvidas que você possa ter e fornecer-lhe as informações que queira, antes, durante ou depois de encerrado o estudo.

i)Caso queira entrar em contato com o comitê de ética, responsável pela aprovação desta pesquisa, poderá contatar o Comitê de Ética e pesquisa da Faculdade Dom Bosco pelo telefone (41) 3218 – 5582. O Comitê de Ética em Pesquisa (CEP) é um colegiado interdisciplinar e independente, com "munus público", que existe nas instituições que realizam pesquisas envolvendo seres humanos no Brasil, criado para defender os interesses dos participantes da pesquisa em sua integridade e dignidade e para contribuir no desenvolvimento da pesquisa dentro de padrões éticos (Normas e Diretrizes Regulamentadoras da Pesquisa Envolvendo Seres Humanos - Res. CNS n.º 466/12).

j) A sua participação neste estudo é voluntária. Contudo, se o(a) Sr.(a) não quiser mais fazer parte da pesquisa tem liberdade para aceitar ou recusar a participação, agora, ou em qualquer momento, e poderá solicitar de volta o termo de consentimento livre esclarecido assinado.

k) O Sr.(a), caso sofra qualquer tipo de dano resultante de sua participação nesta pesquisa, previsto ou não no Termo de Consentimento Livre e Esclarecido, têm direito à indenização prescrita por lei por parte do pesquisador.

l)As informações relacionadas ao estudo poderão ser inspecionadas pelos responsáveis que executam a pesquisa e pelas autoridades legais. No entanto, se qualquer informação for divulgada em relatório ou publicação, isto será feito sob forma codificada, para que a confidencialidade seja mantida.

m) As despesas necessárias para a realização da pesquisa não são de sua responsabilidade e pela sua participação no estudo Sr.(a) não receberá qualquer valor em dinheiro.

n) Quando os resultados forem publicados, não aparecerá seu nome, e sim um código.

Rubricas:
Pesquisador responsável: _____
PARTICIPANTE DO ESTUDO:_____

Comitê de Ética em Pesquisa da Faculdade Dom Bosco
Telefone: (41) 3218 – 5582 e-mail: cep@dombosco.sebsa.com.br

Eu,_____ li o texto acima e compreendi a natureza e objetivo do estudo do qual fui convidado(a) a participar. A explicação que recebi menciona os riscos e benefícios do estudo. Eu entendi também que sou livre para interromper a investigação do projeto e para encerrar a minha própria participação no estudo a qualquer momento, sem precisar justificar minha decisão.

Eu CONCORDO VOLUNTARIAMENTE em participar deste estudo.

Curitiba, ____ de _____ de 2016.

Pesquisador: André Luiz Felix Rodacki

Pesquisador: Mateus Corrêa Silveira

Pesquisador: Paulo Cesar Barauce Bento

Pesquisadora: Natália Boneti Moreira

Pesquisador: Gleber Pereira

Pesquisadora: Renata Wolf

Pesquisadora: Anna Raquel S. Gomes

Pesquisadora: Paula Born Lopes

Pesquisador: Jarbas Melo Filho

APPENDIX II- ETHIC COMMITTEE APROVAL CHAPTER 4

PREFEITURA MUNICIPAL DE CURITIBA-SES

PARECER CONSUBSTANCIADO DO CEP

Elaborado pela Instituição Coparticipante

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: FATORES DE RISCO DE QUEDAS EM IDOSOS: ASSOCIAÇÃO ENTRE ASPECTOS COGNITIVOS, CLÍNICOS E FUNCIONAIS

Pesquisador: NATALIA BONETI MOREIRA

Área Temática:

Versão: 1

CAAE: 48548715.5.3001.0101

Instituição Proponente: Faculdades Dom Bosco/ PR

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.254.580

Apresentação do Projeto:

Ainda estão presentes lacunas quanto aos riscos de quedas de idosos. O presente estudo visa investigar, rastrear e identificar os fatores relacionados ao risco de quedas em idosos de Curitiba – Paraná.

Objetivo da Pesquisa:

Metodologicamente 3 estudos são apresentados, com seus respectivos objetivos:

Estudo 1 - Verificar a associação entre aspectos cognitivos, clínicos e funcionais com episódios de quedas em idosos de Curitiba – Paraná.

Estudo 2 - Traduzir para a língua portuguesa brasileira o questionário de fatores residenciais relacionado ao risco de quedas (HOME FAST), validar e testar a confiabilidade em idosos hígidas da comunidade e idosos frágeis. Analisar a confiabilidade dos testes clínicos para equilíbrio dinâmico e estimar pontos de corte para a triagem de distúrbios de equilíbrio relacionados ao sistema vestibular em idosos da comunidade.

Estudo 3 - Verificar se a percepção de esforço reportada no teste de sentar e levantar com carga constante pode ser utilizada para diferenciar a capacidade funcional de idosos.

Avaliação dos Riscos e Benefícios:

Riscos: A coleta de dados poderá trazer riscos de constrangimento ao idoso, devido a

Endereço: Rua Atílio Bório, 680
Bairro: Cristo Rei **CEP:** 80.050-250
UF: PR **Município:** CURITIBA
Telefone: (41)3360-4961 **Fax:** (41)3360-4965 **E-mail:** etica@sms.curitiba.pr.gov.br

APPENDIX III – BORG scale 6-20

ESCALA DE PERCEPÇÃO SUBJETIVA DE ESFORÇO 6-20

6 SEM NENHUM ESFORÇO

7 EXTREMAMENTE LEVE

8

9 MUITO LEVE

10

11 LEVE

12

13 UM POUCO INTENSO

14

15 INTENSO (PESADO)

16

17 MUITO INTENSO

18

19 EXTREMAMENTE INTENSO

20 MÁXIMO ESFORÇO

Borg G.A. Escalas de Borg para a dor e o Esforço Percebido. Ed. Manole Ltda, 2000.

APPENDIX IV – INSTRUCTION OF BORG SCALE

INSTRUÇÕES PARA USO DA ESCALA DE PERCEPÇÃO DE ESFORÇO

"Durante o exercício queremos avaliar a sua percepção de esforço, ou seja, quão difícil, pesado e árduo você sente o exercício. A percepção de esforço depende de quão difícil está para você exercitar com suas pernas ou braços, quão difícil está para respirar, e a sua sensação geral de cansaço para o exercício. Ele não depende de dor muscular, ou seja, a dor e sensação de queimação em seus músculos de pernas ou braços.

Olhe para esta escala de classificação; queremos usar esta escala de 6 a 20, onde 6 significa "nenhum esforço, praticamente em repouso" e 20 significa esforço máximo". Nove corresponde ao exercício "muito leve". Para uma pessoa normal e saudável é como caminhar lentamente em seu próprio ritmo por alguns minutos. Treze na escala é exercício de "ligeiramente cansativo" mas que ainda se sente bem para continuar. Dezessete na escala ("muito cansativo") é um exercício muito vigoroso. Uma pessoa saudável pode ainda realizar, mas ele realmente tem que esforçar-se. Você se sente muito pesado e muito cansado. Dezenove na escala é exercício exaustivo". Para a maioria das pessoas este é o exercício mais intenso que já experimentou.

Tente avaliar suas sensações de esforço tão honesta quanto possível, sem pensar sobre a carga de trabalho (por exemplo, frequência cardíaca, velocidade, potência ou nível de intensidade da máquina de exercício). Não subestime sua percepção de esforço. É sua própria sensação de esforço que é importante, não como ela se compara a outras pessoas. O que as pessoas pensam não é importante. Olhe atentamente para a escala e suas expressões e, em seguida, dê um número. Alguma dúvida?"

APPENDIX V- KATZ QUESTIONNAIRE SCORE - ADL

ATIVIDADES Pontos (1 ou 0)	INDEPENDÊNCIA (1 ponto) SEM supervisão, orientação ou assitência pessoal	DEPENDÊNCIA (0 pontos) COM supervisão, orientação ou assitência pessoal ou cuidado integral
Banhar-se Pontos: ___	(1 ponto) Banha-se completamente ou necessita de auxílio somente para lavar uma parte do corpo como as costas, genitais ou uma extremidade incapacitada	(0 pontos) Necessita de ajuda para banhar-se em mais de uma parte do corpo, entrar e sair do chuveiro ou banheira ou requer assistência total no banho
Vestir-se Pontos: ___	(1 ponto) Pega as roupas do armário e veste as roupas íntimas, externas e cintos. Pode receber ajuda para amarrar os sapatos	(0 pontos) Necessita de ajuda para vestir-se ou necessita ser completamente vestido
Ir ao banheiro Pontos: ___	(1 ponto) Dirigi-se ao banheiro, entra e sai do mesmo, arruma suas próprias roupas, limpa a área genital sem ajuda	(0 pontos) Necessita de ajuda para ir ao banheiro, limpar-se ou usa urinol ou comadre
Transferência Pontos: ___	(1 ponto) Senta-se/deita-se e levanta-se da cama ou cadeira sem ajuda. Equipamentos mecânicos de ajuda são aceitáveis	(0 pontos) Necessita de ajuda para sentar-se/deitar-se e levantar-se da cama ou cadeira
Continência Pontos: ___	(1 ponto) Tem completo controle sobre suas eliminações (urinar e evacuar)	(0 pontos) É parcial ou totalmente incontinente do intestino ou bexiga
Alimentação Pontos: ___	(1 ponto) Leva a comida do prato à boca sem ajuda. Preparação da comida pode ser feita por outra pessoa	(0 pontos) Necessita de ajuda parcial ou total com a alimentação ou requer alimentação parenteral

Total de Pontos = _____	6 = Independente	4 = Dependência moderada	2 ou menos = Muito dependente

Fonte: The Hartford Institute for Geriatric Nursing, 1998[20]

APPENDIX VI –LAWTON QUESTIONNAIRE SCORE - IADL

a) Em relação ao Telefone:
( )³ Recebe e faz ligações sem assistência
( )² Necessita de assistência para realizar ligações telefônicas
( )¹ Não tem hábito ou é incapaz de usar telefone

b) Em relação as viagens:
( )³ Realiza viagens sozinha
( )² Somente viaja quando tem companhia
( )¹ Não tem o hábito ou é incapaz de viajar

c) Em relação a realização de compras:
( )³ Realiza compras, quando é fornecido o transporte
( )² Somente faz compras quando tem companhia
( )¹ Não tem o hábito ou é incapaz de realizar compras

d) Em relação ao preparo de refeições:
( )³ Planeja e cozinha as refeições completas
( )² Prepara somente refeições pequenas ou quando recebe ajuda
( )¹ Não tem o hábito ou é incapaz de preparar refeições

e) Em relação ao trabalho doméstico:
( )³ Realiza tarefas pesadas
( )² Realiza tarefa leves, necessitando de ajuda
nas pesadas
( )¹ Não tem o hábito ou é incapaz de realizar trabalhos domésticos

f) Em relação ao uso de medicamentos:
( )³ Faz uso de medicamentos sem assistência
( )² Necessita de lembretes ou assistência
( )¹ É incapaz de controlar sozinho o uso de medicamentos

g) Em relação ao manuseio do dinheiro:
( )³ Preenche cheque e paga contas sem auxílio
( )² Necessita de assistência para o uso de cheques e contas
( )¹ Não tem o hábito de lidar com o dinheiro ou é incapaz de manusear dinheiro, contas...

Classificação:

( ) Dependência total = < 5 (P25)

( ) Dependência parcial = > 5 < 21
(>P25 <P100)

( ) Independência = 21 (P100)

APPENDIX VII – CONSENT FORM OF CHAPTER 5

Pesquisadores responsáveis:
Prof. Dr. Gleber Pereira, Prof. Dr. Angélica Lodovico e Prof. Ms. Paula Born Lopes

Este é um convite especial para a participação voluntária do estudo titulado: **"SENSIBILIDADE DA PERCEPÇÃO SUBJETIVA DE ESFORÇO AO TREINAMENTO FÍSICO PARA DIFERENCIAR A CAPACIDADE FUNCIONAL DE IDOSOS.** Por favor, leia com atenção as informações abaixo antes de aceitar ou não sua participação no estudo. Qualquer dúvida sobre o estudo ou sobre este documento, pergunte diretamente ao pesquisador com quem você está conversando neste momento ou entre em contato através dos seguintes telefones: CECOM 3360-4333 – 91836040. Sua participação é muito importante, pois é através de pesquisas como esta que ocorrem os avanços científicos em todas as áreas.

O objetivo desta pesquisa é verificar se a percepção subjetiva de esforço mencionada nos testes constantes consegue diferenciar a capacidade funcional de idosos após um período de treinamento multicomponente.
Caso você participe da pesquisa, será necessário realizar um programa de exercício (treinamento mutlicomponente), a ser definido por sorteio, durante 12 semanas (às segundas, quartas e sextas, das 14:30 às 15:30h) e será avaliado a sua força, equilíbrio e capacidade funcional antes e após o treinamento. Haverá a possibilidade de você ser sorteado para participar apenas de encontros semanais que compreenderão exercícios de flexibilidade e palestras sobre saúde durante o período do estudo. Neste caso, após 12 semanas de encontros semanais, você terá a oportunidade de participar dos programas de atividade física ofertados por outros projetos da universidade. As avaliações, reuniões e exercícios serão realizados na instituição de longa permanência que a senhora reside (Lar João Maria José, R. Otávio de Sá Barreto, 75 - São Sebastiao, São José dos Pinhais ou no lar Vovó Joana, Rua João Viana Seiler, 436, bairro Parolin).

Como em qualquer tratamento, você poderá experimentar algum desconforto, principalmente relacionado à dor muscular após ou durante a realização dos exercícios, que são comuns quando se pratica atividade física. No entanto, não haverá necessidade de maiores preocupações, pois os exercícios serão adaptados de acordo com a capacidade de cada indivíduo, verificada nas avaliações. Além disso, se for observado qualquer sinal de esforço maior durante a realização dos exercícios, os mesmos serão readaptados ou encerrados.

Ao participar do treinamento o (a) senhor(a) corre o risco de em algum momento machucar-se ou sentir dores no corpo devido ao esforço. Para prevenir essas ocorrências, as aulas terão um período de aquecimento com atividades leves, a carga dos exercícios será individualizada e a intensidade será aumentada gradativamente, à medida que o (a) senhor(a) se adapte ao esforço. Além disso, você sempre terá sua pressão aferida antes do início dos exercícios. Caso sua pressão inicial apresente valores acima do recomendado, você não realizará os exercícios e se durante os

exercícios você sentir falta de ar, tontura e/ou dores no peito, cabeça e pernas, a atividade física será encerrada.

As avaliações serão realizadas durante uma semana, aproximadamente com duração de 1 (uma) hora por dia. Os exercícios terão duração de aproximadamente 45 min e serão realizados 3 vezes por semana, também na instituição de longa permanência que o(a) senhor(a) reside. O intervalo entre as sessões será de 12 semanas que compreenderão ao período de treinamento.

Neste intervalo de tempo você irá participar de um treinamento multicomponente, realizado três vezes por semana. Em cada sessão serão realizados 6 (seis) exercícios de força, com 3 (três) séries de 12 (doze) repetições em cada exercício. O intervalo entre as séries será de 2 (dois) minutos. A intensidade do treinamento será determinada em relação ao número de repetições máximas, onde você será sempre estimulado (a) a utilizar uma carga que possibilite a realização de no mínimo 10 e no máximo 12 repetições. Após o período de treinamento de força será realizado 20 minutos de exercícios de agilidade e equilíbrio.

Contudo os benefícios esperados são: melhora no equilíbrio (capacidade de manter o corpo em uma posição), melhora na força muscular, melhora na flexibilidade (capacidade de mover uma articulação, também conhecida como junta), melhora na caminhada, melhora na capacidade do corpo de suportar exercícios prolongados e melhora no desempenho das atividades diárias.

A pesquisadora Paula Born Lopes, educadora física, mestre e doutoranda em Educação física, é a responsável pelo seu treinamento e poderá esclarecer dúvidas a respeito desta pesquisa. Você poderá entrar em contato com ela pelo telefone (41) 91836040, e-mail: paulinhaborn@gmail.com ou na Universidade Federal do Paraná (Rua Coração de Maria, 92 Jardim Botânico Curitiba – Paraná) às segundas, quartas e sextas das 10:00h às 17:00h.

A sua participação neste estudo é *voluntária* e você terá plena e total liberdade para desistir do estudo a qualquer momento, sem que isso acarrete em qualquer prejuízo para você.

As informações relacionadas ao estudo são confidenciais e qualquer informação divulgada em relatório ou publicação será feita sob forma de códigos, para que seu sigilo seja mantido. O pesquisador garante que seu nome não será divulgado sob hipótese alguma.

Todos os sujeitos envolvidos nesta pesquisa são isentos de custos e ressarcimentos.

Eu,_____ li o texto acima e compreendi o objetivo do estudo do qual fui convidado(a) a participar. A explicação menciona os riscos e benefícios do estudo e os tratamentos alternativos. Eu entendi que sou livre para interromper minha participação no estudo a qualquer momento sem justificar minha decisão e sem que esta decisão afete meu tratamento. Eu entendi o que não posso fazer durante o tratamento e sei que qualquer problema relacionado ao tratamento será tratado sem custos para mim.
Eu concordo voluntariamente em participar deste estudo.

_____
(Assinatura do sujeito de pesquisa ou responsável legal)

_____
Local e data

_____
Identificação do Responsável

APPENDIX VIII- ETHIC COMMITTEE APROVAL CHAPTER 5

FACULDADE INSPIRAR

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: TREINAMENTO FÍSICO PARA DIFERENCIAR A CAPACIDADE FUNCIONAL DE IDOSOS

Pesquisador: Paula Born Lopes

Área Temática:

Versão: 2

CAAE: 56119316.0.0000.5221

Instituição Proponente: Faculdade Inspirar

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.650.251

Apresentação do Projeto:

Considerando que a capacidade funcional é um fator determinante para a qualidade de vida do idoso, o presente estudo objetiva verificar se a percepção subjetiva de esforço reportada nos testes com cargas constantes tem sensibilidade para diferenciar a capacidade funcional de idosos após um período de treinamento multicomponente.

Objetivo da Pesquisa:

O projeto de pesquisa apresenta como objetivo geral verificar se a percepção de esforço tem sensibilidade ao treinamento físico para diferenciar a capacidade funcional de idosos, considerando duas hipóteses: (a) o teste de sentar e levantar realizado com carga constante é capaz de diferenciar a a capacidade funcional de idosos e (b) a percepção de esforço nos testes com cargas constantes é capaz de diferenciar a capacidade

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APPENDIX IX – DESCRIPTION OF STRENGTH EXERCISES OF MULTICOMPONENT TRAINING

SHOULDER!FLEXION:!Participant!was!placed! seated,! with! approximately! 90º! knee! joint! flexion.! Participant! performed! shoulder! flexion! and! elbown! extension! against! resistance,! by! vertically! pushing! up! the! load! until! locking! of! shoulder! occurs.! In! order! to! exercise! the! following! muscles:! deltoid,! pectoralis!major!and!triceps.!

!

ABDUCTOR:!Participant!was!standing!with!one! leg! supported! and! the! other! leg! did! the! abduction! laterally.! Participant! performed! a! hip!abduction!movement!against!resistance,!in! order! to! exercise! the! following! muscles:! gluteus! medius,! gluteus! maximus! and! tensor! fascia!lata.!

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KNEE! FLEXION:! Participant! was! placed! standed,! with! the! knee! extended.! Participant! performed! the! knee! flexion! movement!against!resistance,!in!order!to! exercise! the! following! muscles:! hamstrings,!gastrocnemius,!sartorius!and! gracilis.!

!

CALF:! Participant! was! standing,! supported! feet! on! ground.! Participant! performed! plantar! flexion! of! the! ankle! joint,! in! order! to! exercise! the! following! muscles:! gastrocnemius,! soleus! and! plantar!(plantar!flexion).!

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!

ELBOW FLEXION: Participant was placed seated, with approximately 90º flexion of the knee joint. Participant performed the flexion and extension of the elbows, in order to exercise the biceps muscle.

KNEE EXTENSION: Participant was placed seated, with flexion of approximately 115º of hip joint and 90º of knee joint. Participant performed the extension movement of knee joint against resistance, in order to exercise the following muscles: quadriceps femoris.

PUSH UPS: Participant was positioned standing facing the wall. Participant placed the hands on the wall with elbows extended. The objective was to flex the elbows and bringing the chest closer to wall. In order to exercise the following muscles: pectoralis major, minor and triceps.

SIT TO STAND: Participant was positioned seated on a chair. Participant placed hands in front of chest and was instructed to get up and sit down from the chair in order to exercise the following muscles: quadriceps, major gluteus, minor gluteus.

APPENDIX X – DESCRIPTION OF CARDIOVASCULAR EXERCISES OF MULTICOMPONENT TRAINING

WALKING IN ZIGZANGING: Participant was asked to walk behind the cons.

UP AND DOWN STEP: Participant was asked to get up and down from the step.

KNEE LIFT: Participant was standing and as fast as possible lifted the knee.

WALKING: Participant was asked to walk in the room and grabing some objectives on the floor.

GET IN AND OUT OF THE CIRCLE: participant was asked to enter in the circle with two feets and go to the next one.