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Relationship between level of independence in activities of daily living and estimated cardiovascular capacity in elderly women

Letícia Vargas de Oliveira Brito [a,b,*], Geraldo Albuquerque Maranhao Neto [c], Helena Moraes [d,e], Raphael Fonseca e Silva Emerick [b], Andrea Camaz Deslandes [d,e]

[a] Exercise and Sport Sciences Graduate Program, Gama Filho University, UGF, Rio de Janeiro, Brazil
[b] Undergraduate Program in Physical Education, PPGCEE, Gama Filho University, UGF, Rio de Janeiro, Brazil
[c] Undergraduate Program in Physical Education, Universo University, Rio de Janeiro, Brazil
[d] Center for Alzheimer Disease and Related Disorders, Institute of Psychiatry, Universidade Federal do Rio de Janeiro – UFRJ, Rio de Janeiro, Brazil
[e] Neuroscience of Exercise Laboratory, LaNEx, UFRJ, Rio de Janeiro, Brazil

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ABSTRACT

Elderly individuals undergo a progressive decline in functional capacity related to increased risk of dependency, loss of autonomy, and frailty. A lower cardiorespiratory fitness level is associated with cardiovascular disease events and mortality from all causes. The Veterans Specific Activity Questionnaire (VSAQ) was developed to facilitate prediction of the exercise capacity in older people with cardiovascular disease. However, few studies have investigated the relationship between the VSAQ and functional capacity in elderly women. This study investigated the relationship between functional capacity and the estimated cardiovascular capacity in elderly women, as assessed by the VSAQ. In this descriptive, observational, cross-sectional study, we evaluated 37 healthy elderly women (aged 70 ± 7 years). The assessment protocols used were the following: Anamnesis, VSAQ and nomogram (age adjusted), Senior Fitness Test (30-s chair stand, to assess lower-body strength; 8-foot up-and-go test, to assess agility-dynamic balance; and 2-min step test, to assess aerobic endurance). The Spearman test showed a significant correlation ($p < 0.001$) between the functional tests and the VSAQ (8-foot up-and-go test $r_s = -0.715$; 2-min step test $r_s = 0.567$; 30-s chair stand $r_s = 0.582$). Adjustment of the results by age improved the correlation (8-foot up-and-go test $r_s = -0.760$; 2-min step test $r_s = 0.627$; 30-s chair stand $r_s = 0.601$). The VSAQ seems to be a simple way to estimate functional capacity, particularly in older women.

1. Introduction

The aging process is accompanied by a decline in the ability to respond to stress, and an increase in both homeostatic imbalance and the incidence of diseases. There is a progressive reduction of functional capacity related to aging, due to declines of more than 5–10% of the maximal aerobic capacity for every 10 years of life (American College of Sports et al., 2009). The alterations that occur in cardiovascular fitness with advancing age may dramatically decrease the functional capacity. Lower maximal oxygen consumption in older adults is usually related to difficulties with activities of daily living (Hawkins & Wiswell, 2003). These declines increase the risk of dependency, loss of autonomy, and frailty in elderly individuals. Specifically, studies have observed that both cardiovascular capacity and lower limb strength are associated with reduced functional performance and disability in the elderly (Bassey et al., 1992; Bortz, 2002).

Progress in medicine and public health continues to improve the prevention and treatment of several diseases associated with aging, and to increase the overall longevity of populations (Weinert & Timiras, 2003). Even in old age, a healthy and active lifestyle can contribute to prevent mortality. A lower cardiorespiratory fitness level (7 METs for men and 5 METs for women) is associated with cardiovascular disease events and mortality from all causes (Kodama et al., 2009). This result could be explained, in part, by coronary risk factors (Knoops et al., 2004). The directly measured maximal oxygen intake (VO_{2max}) is considered the gold standard for assessing aerobic capacity. In spite of its importance, this procedure involves some difficulties with the assessment, including the time required to perform it, the high cost of the material

* Corresponding author at: Rua Manoel Vitorino, 553, 20748-900 Rio de Janeiro, RJ, Brazil. Tel.: +55 21 25997138; fax: +55 21 25997138.
E-mail address: prof.leticia@gmail.com (L.V. de Oliveira Brito).

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and human resources, the need for a medical professional, and the risk associated with maximal effort (Arena et al., 2007).

Some alternatives have been developed to estimate exercise capacity without an exercise test (Maranhão-Neto, Leon, & Farinatti, 2011; Matthews, Heil, Freedson, & Pastides, 1999; Myers, Bader, Madhavan, & Froelicher, 2001). The VSAQ was developed to facilitate predicting exercise capacity in older people with cardiovascular disease (Myers, Do, Herbert, Ribisl, & Froelicher, 1994). This simple self-administered questionnaire predicted all-cause mortality, showing that higher VSAQ scores (8 METs) were associated with a more than 75% reduction in mortality risk (McAuley, Myers, Abella, & Froelicher, 2006). Some studies have investigated the validity and reliability of the VSAQ and have shown moderate to strong correlation with peak VO_2 as assessed by a maximal test (Maranhão-Neto, Leon, & Farinatti, 2008; Matthews et al., 1999; McAuley et al., 2006; Myers et al., 1994, 2006). Myers and colleagues (2006) found a significant correlation between the VSAQ and the 6-min walk test. Kojima et al. (2006) also investigated exercise capacity predicted by the VSAQ and found a moderate correlation between the 6-min walk test distance and the estimated exercise capacity.

Although the average life expectancy is higher in women, the VSAQ validation studies with a direct measurement of VO_2 were conducted with samples consisting of 70% men (Maeder et al., 2005; Maranhão-Neto et al., 2011; Myers et al., 2001; Pierson et al., 2003; Rankin, Briffa, Morton, & Hung, 1996). The differences in cardiovascular fitness between the sexes are partly explained by the higher concentration of hemoglobin, the larger amount of muscle mass, and the increased stroke volume in men. The maximum oxygen consumption, measured directly, is 10–20% higher in men than in women (Arena et al., 2007).

The prevalence of frailty is higher among women than age-matched men. In a cohort study investigating frailty in 5317 elderly people, 6.9% were considered frail (7.3% women; 4.9% men) (Fried et al., 2001). Frailty affects mobility tasks before causing disabilities or ADL impairment. Thus, the lower functional capacity and the higher prevalence of frailty in this population could limit some exercise test procedures. Measurements of functional capacity can help to maintain the ability to perform activities of daily living (ADL), thus preventing the frailty syndrome in the elderly. Functional tests are increasingly used, and the relationship among these tests is being widely studied. The present study investigated the relationship between functional capacity and the estimated cardiovascular capacity, as assessed by a VSAQ test questionnaire. We hypothesized that there is a strong relationship between the VSAQ and functional tests, especially in the 2-min step test, since this test was developed to assess cardiovascular fitness in the elderly.

2. Subjects and methods

2.1. Study design and sample selection

In this descriptive, observational, cross-sectional study, we evaluated 37 healthy elderly females, aged over 60 (70 ± 7) years. The subjects were conveniently recruited from the Third-Age Open University program in Gama Filho University, from the Major' Third-Age Gym Program offered in Rio de Janeiro parks, and in private nursing homes. We excluded elderly women who could not perform the tests or could not read. The study was conducted from July 2011 to January 2012.

2.2. Ethics

This research was conducted in accordance with the ethical principles established by the Declaration of Helsinki, and was registered in Clinical Trials: id NCT01526109. The design and completion of informed consent were also approved by the Research Ethics Committee of Gama Filho University, under number 040.2011.

2.3. Procedures and tests

2.3.1. Medical history

The subjects completed a questionnaire providing personal data including name, age, family history, personal history, medications, psychological treatment, and if they had any disease or bone-tissue impairment.

2.3.2. VSAQ

To evaluate the physical fitness without exercise, we used the Portuguese version of the VSAQ (Maranhão-Neto et al., 2011; Myers et al., 2001). The VSAQ is an easily understandable and brief questionnaire, consisting of a list of activities, presented in progressive order, according to their metabolic equivalents (METs). We also evaluated the nomogram developed by Myers and colleagues, which considers age and functional capacity based on the VSAQ, using the equation: Predicted METs = 4.74 + 0.97 (VSAQ) − 0.06 (Age) (Myers et al., 1994).

2.3.3. Senior Fitness Test

The Senior Fitness Test is a simple test battery to assess the level of independence in activities of daily living in older adults. Since cardiovascular function and lower limb strength are associated with reduced functional capacity, we used the three main tests of strength and resistance of lower limbs from the Senior Fitness Test battery (Rikli & Jones, 2012).

2.3.3.1. 30-s chair stand. To assess lower-body strength, which is needed for numerous tasks such as climbing stairs, walking, and getting out of a chair or a car. Better ability to perform this exercise may reduce the chance of falling in elderly people. The participant is positioned sitting in the middle of the chair with feet flat on the floor and arms folded across the chest. At the signal "go" the participant stands up and then back to the sitting position. After a warmup and familiarization, the test is administered. The score is the number of full stands completed in 30 s. This test has a high reliability ($r = 0.89$) and was validated with the test of one-repetition maximum – 1 RM for knee and hip extension performed on the leg press machine ($r = 0.77$) (Rikli & Jones, 2012).

2.3.3.2. 8-foot up-and-go test. To assess the agility-dynamic balance, important in tasks that require quick maneuvering from the participant, such as getting up to attend to something, crossing the street, or getting off a bus in time. The participant is instructed to rise from a chair 45 cm high and walk 2.44 meters (8 feet) toward a cone, turn, and return to the seated position. The time is marked from the signal "go", when the participant rises, until the end of the movement, i.e., the time when the participant sits in the chair. After familiarization, three tests are applied. The best score corresponds to the minimum test time. This test has a high reliability ($r = 0.95$) and does not have a sole criterion for validation. It is considered a good alternative to measure power, speed, and agility combined with balance, which capture basic skills (Rikli & Jones, 2012).

2.3.3.3. 2-min step test. To assess aerobic endurance, the 2-min step is an alternate test to the 6-min walk test, and can be used when there are time and space limitations on the 6-min walk test. A mark is drawn on a wall or door with the use of tape, respectively midway between the subject' patella and the iliac crest. After the signal "go" the participant must alternate steps, without moving