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Original Article

Motor performance tests as screening instruments for frailty in the older adults

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ABSTRACT

Objective: To verify the association between frailty and motor performance, and identify which test is the best predictor of frailty in the older adults.
Methods: Cross-sectional, population- and home-based study that analyzed data from 286 older adults. The association between physical performance tests and frailty was verified by binary logistic regression. The diagnostic power of the performance tests and the identification of the best cut-off points to frailty were evaluated using the ROC curve and the area under the ROC curve.
Results: The prevalence of frailty was 23.8%. Frailty was associated with worse performances in the 'chair stand' test ($p = <0.01$) and the 'pick up a pen' test ($p = <0.01$). Performance requiring more than 14 seconds in the 'chair stand' test proved to be a good criterion for discriminating frailty in the older adults, considering the sensitivity and specificity.
Conclusion: The worst performances in the tests were associated with the frailty syndrome. All tests were able to predict frailty in the older adults. However, taking into account the high sensitivity of the use of the 'pick up a pen' test to confirm a diagnosis of frailty (84.6%), this is recommended for use in home environments.

1. Introduction

The life expectancy of humans has increased continuously. This has led to discussions about health conditions, care and interventions that will directly influence the functional aspect of older adults and the difficulties to which they are exposed (Veras, 2009). Among the problems that occur with aging, the decline in motor performance and frailty are among the events that most negatively impact their health, for the higher the degree of frailty in older adults, the more functional impairment they will come to acquire (Chen, Mao, & Leng, 2014).

Frailty is a multifactorial clinical syndrome, which generates a decrease in energy reserves and ability to recover after destabilizing factors, resulting in a physiological state of vulnerability, limiting the functionality and autonomy (Fried et al., 2004). Consequently, frail older adults become more tired, undergo weight loss, have decreased overall muscle strength, and an energy balance deficit (Bandeen-Roche et al., 2006). Thus, the weakening process of older adults has become a serious public health issue since it brings the decline in functional capacity and quality of life. The impact on the affected individual may include increased comorbidity, disability, hospitalization, falls and poor motor performance (Chen et al., 2014; Fhon et al., 2013).

The motor performance and the frailty syndrome are related to the functional decline of the individual and are key markers for determining the activity in older adults. Currently, motor performance is assessed by self-reporting or by motor tests. Motor performance measurement in older adults through motor tests is useful and fairly representative. It can be used in both primary health care and epidemiological research, with the advantage of its low cost and easy application. It requires little time and provides information regarding physical parameters involved in various activities associated with older adults. Motor tests have greater validity, sensitivity, reproducibility and applicability compared to other forms of assessment, such as self-reporting (Guralnik & Ferrucci, 2003).

Thus, motor performance tests may constitute viable instruments for screening and monitoring frailty in older adults. However, on reviewing the literature, we noted that there is a scarcity of studies assessing motor performance tests as frailty predictors. Given this problem, it is still not clear whether performance tests are able to distinguish frailty in older adults and which test has the best predictive capacity as a diagnostic tool for the frail older adults and assist with the prevention of this condition through the early detection of situations and factors that may lead to decline of motor performance in older adults and consequently cause the frailty. Aiming to fill these gaps in knowledge, the objective of this study is to assess the association between frailty and

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motor performance tests, and identify which test is a reliable discriminator of frailty in older adults.

2. Materials and methods

This is a cross-sectional study that used data from an epidemiologic population-based household survey entitled "Nutritional status, risk behaviors, and health conditions of the older adults of Lafaiete Coutinho - Bahia, Brazil". The municipality is located in the greater region of Central South Bahia and has a population composed of 3901 inhabitants with generally low social, educational and health indicators, and a predominantly rural work source (Instituto Brasileiro de Geografia e Estatística - IBGE, 2013).

Data collection was conducted in January 2011, and had the approval of the Ethics'Research Committee of the State University of Southwest Bahia (N°064/2010). The participation was voluntary, and all participants signed an informed consent, which explained the purpose of research, its risks, benefits, and other relevant issues.

All urban dwelling individuals aged ≥ 60 years (n = 355) were contacted for interviews and motor tests. Their places of residence were identified using information from The Family Health Strategy, a program that covers the entire county and aims to increase the population's access to primary health care (Brandão et al., 2011). We then carried out a visit at the home of all older adults to conduct personal face-to-face interviews including sociodemographic information, health status and lifestyle as well as motor performance tests. Of the 355 older adults who made up the study population, 316 (89.0%) were survey respondents; 17 refusals were recorded (4.8%) and 22 (6.2%) individuals were not located after three home visits every other day, these thus being considered as losses. However, after screening by frailty criteria, which will be explained below, 286 older adults, were found to be eligible for analysis.

The interview was based on a form utilized in the Survey on Health, Welfare, and Aging (*Salud, Bienestar y Envejecimiento* - SABE) in seven Latin American countries and the Caribbean (http://hygeia.fsp.usp. br/sabe/Questionario.html) (Albala et al., 2005). To this was added the International Physical Activity Questionnaire (IPAQ), long version (Craig et al., 2003), and the Geriatric Depression Scale (GDS) in its Brazilian and shortened version of 15 items (Almeida & Almeida, 1999). Before the interview, cognitive function was evaluated with a modified Mini-Mental State Examination (Icaza, Albala and Projeto SABE, 1999); subjects with scores below 13 were also asked to answer questions related to the Pfeffer Scale of Functional Capacity (score ≥ 6 = altered) (Pfeffer et al., 1982). If the participant presented cognitive impairment, the assistance of a proxy respondent was required.

2.1. The dependent variable (frailty)

Frailty was defined as consisting of five components (Fried et al., 2001): 1. Shrinking: this was defined by self-reporting of unintentional weight loss of more than 3 kg during the 12 months preceding the study – adapted by Alvarado et al. (2008), given that the method used was based on the SABE survey, which does not make objective estimates of weight loss. 2. Weakness: was evaluated by means of a hydraulic hand dynamometer (SH5001 Saehan Corporation, Korea). Weakness was thus determined and corrected according to sex and body mass index (BMI). For each category, the cutoff point for the hand grip strength (HGS) was set at the 25th percentile, with adjustment for gender and BMI. The cutoff points for men were: 0 < BMI< 22 - HGS ≤ 19 kgf; 22 ≤ BMI ≤ 27 - HGS ≤ 21 kgf; BMI> 27 - HGS ≤ 22 kgf; and for women: 0 < BMI< 22 - HGS ≤ 11 kgf; 22 ≤ BMI <27 - HGS ≤ 15 kgf; BMI> 27 - HGS ≤ 14 kgf. 3. Poor endurance/exhaustion: was defined based on two questions of the GDS (Almeida & Almeida, 1999): "Have you dropped many of your activities and interests?" and "Do you feel full of energy?". A positive answer to the first question and/or a negative response to the second were considered indications of poor resistance/exhaustion. 4. Slowness: this was defined through physical performance on the 8-foot walk test (Guralnik et al., 1994). The slowness was defined according to the sex and height. First, the older adults were classified into two categories according to the height's median (50th percentile): ≤ median (men ≤1.61 and women ≤1.49 m) and > median (men >1.61 and women >1.49 m). The cutoff points of time spent to perform the walk test were then fixed at the 75th percentile for each height's category. Thus, the following cut-off points were set for slowness: height ≤ median, ≥ 5 and ≥6 seconds, for men and women, respectively; height > median, ≥ 4 seconds for both sexes. Older adults who were unable to perform the test due to physical limitations were classified as slow (i.e., slowness category). 5. Low level of physical activity: the method used to assess the level of habitual physical activity was the IPAQ (Craig et al., 2003). Individuals who took less than 150 minutes per week of moderate and/or vigorous physical activity were considered insufficiently active.

An ordinal variable with scores ranging from zero to five (0–5) was created from the sum of points of all components and the following classification was adopted, adapted from the study by Fried et al. (2001): ≥ 3 points = frail, <3 = non-frail.

2.2. Independent variables (motor performance tests)

Motor performance tests were carried out during the application of the form, in the home residence of the participants. For all performance tests the older adults were instructed on how to perform the tests. It was necessary that the older adults take the test alone. Assistance from a third-party was not allowed. Those older adults who refused to take the tests or were unable to understand the instructions, due to cognitive problems, were excluded from the analyses.

The older adults unable to perform the tasks, due to physical limitations, were included in the collection: those who could not walk or needed help to keep standing, had paralysis in either limb, wore leg prosthesis, or could not keep their balance did not perform the tests related to the lower limbs. Those who had undergone eye surgery in the last six weeks did not perform the test requiring them to squat and pick up a pen.

The 'chair stand' test was used to assess the strength/endurance of the lower limbs. Participants were invited to sit, put their arms crossed on their chest and stand up and sit down on a chair five times, as fast as possible, with time being timed in seconds (s). The individual was considered capable of performing the test, when he could complete it in ≤60 s.

The 'pick up a pen' test was used to verify mobility/flexibility. For this task, participants were asked to try to remain standing with their feet side by side. When the interviewer informed the start of the test, they should bend down and pick up a pencil, which was placed on the floor, 30 cm in front of their feet, and return to starting position, with the time being timed in seconds. The individual was considered capable of performing the test when he could complete it without any support in ≤30 seconds.

Reliability of the physical performance measures has been shown to be remarkably high in the U.S. populations, with intra class correlation coefficient (ICC) values ranging between 0.88 and 0.92 (Ostir et al., 2002). In Brazil, the physical performance tests have been widely used in population studies (Barbosa et al., 2005; Danielewicz et al., 2014) and test–retest reliability was high with ICC ranging between 0.87 and 0.93 (Cardoso et al., 2013).

2.3. Adjustment variables

The adjustment variables chosen were: age group, sex, hospitalization, functional capacity and self-perceived health. These variables were selected and categorized according to a recently published study which found associations of them with frailty in the surveyed population (Reis Junior et al., 2014).