

Correlation between the walk, 2-minute step and TUG tests among hypertensive older women

Correlação entre os testes da caminhada, marcha estacionária e TUG em hipertensas idosas

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Abstract

Background: The increase in chronic diseases among older adults, especially systemic arterial hypertension, a disease that is closely related to declining functional capacity, has created the need to study methods for activity evaluation in order to detect functional capacity levels, prescribe exercises and monitor motor and cardiovascular function. The Six-Minute Walk Test (6MWT), Two-Minute Step Test (2MST) and Timed Up and Go Test (TUG) are indicated for such evaluations. Studies among healthy older adults have shown associations between these tests, thus aiding the evaluation of functional capacity. However, there are no studies on the relationships between the 6MWT, 2MST and TUG among hypertensive individuals, thus justifying the present research. **Objectives:** To investigate whether there is any association between aerobic endurance and functional mobility among hypertensive older women. **Methods:** This was a cross-sectional observational and analytical study on 32 hypertensive older women who were evaluated using the 6MWT, 2MST and TUG. **Results:** There was a moderate positive correlation between the 6MWT and 2MST ($r=0.36$; $p=0.04$), and there were moderate negative correlations between the 6MWT and TUG ($r=-0.59$; $p=0.000$) and between the 2MST and TUG ($r=-0.66$; $p=0.000$). **Conclusions:** For hypertensive older women, the 6MWT can be replaced by the 2MST; the same applied to healthy older adults. Regarding the correlation between the 6MWT, 2MST and TUG, it can be concluded that there is a close relationship between cardiovascular endurance and functional mobility. When there is lower cardiovascular endurance, there is precarious functional mobility and vice versa.

Key words: hypertension; aging; physical fitness.

Resumo

Contextualização: O aumento de doenças crônicas em idosos, principalmente da Hipertensão Arterial Sistêmica, doença intimamente relacionada ao declínio da capacidade funcional, determina a necessidade do estudo de métodos de avaliação da realização das atividades, possibilitando detecção de níveis de capacidade funcional, prescrição de exercícios e acompanhamento das funções cardiovascular e motora. O teste da caminhada de 6 minutos (TC6'), o teste da Marcha Estacionária de 2 minutos (TME2') e o teste Timed Up and Go (TUG) são indicados para esta avaliação. Estudos em idosos saudáveis mostram a associação entre esses testes, facilitando a avaliação da capacidade funcional. Porém, em hipertensos, não existem estudos que avaliem a relação entre TC6', TME2' e TUG, justificando a realização desta pesquisa. **Objetivos:** Verificar se existe associação entre *endurance* aeróbia e a mobilidade funcional em idosas hipertensas. **Métodos:** Estudo observacional, analítico e transversal, com 32 hipertensas idosas, avaliadas por meio do TC6', TME2' e TUG. **Resultados:** Houve correlação positiva moderada entre TC6' e TME2', $r=0,36$ ($p=0,04$) e correlação negativa moderada entre TC6' e TUG, $r=-0,59$ ($p=0,000$) e entre TME2' e TUG, $r=-0,66$ ($p=0,000$). **Conclusões:** Para hipertensas idosas, o TC6' pode ser substituído pelo TME2', assim como em idosos saudáveis. Quanto à correlação entre os TC6', TME2' e TUG, pode-se concluir que existe uma íntima relação entre resistência cardiovascular e mobilidade funcional; havendo menor resistência cardiovascular, há mobilidade funcional precária e vice-versa.

Palavras-chave: hipertensão; envelhecimento; aptidão física.

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Introduction

Functional capacity refers to the potential to perform activities of daily living (ADLs) or to accomplish a task unassisted, and it is vital to ensuring a better quality of life¹. Several recent studies²⁻⁴ have focused on evaluating and regaining functional capacity or preventing its decline, particularly in older adults^{5,6}. The significant increase in the prevalence of chronic degenerative diseases in older adults⁷, especially systemic hypertension or high blood pressure (HBP) which is closely associated with the decline in functional capacity^{8,9}, has created the need to study evaluation methods for ADL performance. These methods allow the detection of functional capacity levels, evolution from one level to another, personalized prescription of exercises and motor development monitoring^{10,11}.

The tests that evaluate the functional capacity of physically independent older adults should focus mainly on locomotion ADLs because they are the most frequent and the most difficult to perform. According to Andreotti and Okuma¹², who studied physically independent older adults, the locomotion ADLs are evaluated by the Six-Minute Walk Test (6MWT), the Two-Minute Step Test (2MST) and the Timed Up and Go (TUG) test¹³. The 6MWT is widely used as a practical and affordable way to evaluate aerobic capacity. It is easily applied, well tolerated, and it reflects ADLs well^{5,7,14}. The 2MST evaluates aerobic capacity and also does not need expensive equipment, which allows its use in the community, with the advantage that it can be used in limited amounts of space^{13,15}. The TUG test is a combined measure that involves power, velocity, agility and dynamic balance¹⁴, with the objective of evaluating functional mobility¹⁶ in activities which include standing up, walking, turning 180° and sitting down, such as getting off a bus or standing up in time to go to toilet or answering the telephone^{13,14}.

There is still little research on the relationships between these tests. Jones and Rikli¹³ studied the relationship between the 6MWT and the 2MST in older healthy adults and found similarities between the tests. The conclusion was that the 2MST is an alternative which can substitute the 6MWT. Some studies^{15,17} have used the 2MST to evaluate aerobic capacity. Cho, Escarpac and Alexander¹⁸ found a strong and negative correlation between the 6MWT and the TUG test in older adults with a slight change in balance, however this finding was not the focus of the study and no explanation was given for it. The lack of studies which evaluate the relationship between these tests, especially in the hypertensive population, justifies the present study. Based on this evidence and given the absence of studies on the correlation between these functional capacity evaluation

tests, especially in hypertension, the present study sought to investigate whether there is an association between the two aerobic capacity tests and between aerobic endurance and functional mobility among older hypertensive women, using the 6MWT, 2MST and TUG test.

Methods

Subjects

Thirty-two hypertensive, female participants of an HBP assistance and care program were evaluated. The program offers the assistance of a multiprofessional team composed of a cardiologist, a physical therapist, a physical educator, a social worker, a psychologist, a nurse and a nutritionist. It also provides monthly informative lectures and leisure activities (walking, water aerobics on the beach, ballroom dancing, tours, theme parties on special holidays) and distributes HBP medication.

The inclusion criteria of the present study were: diagnosis of HBP with use of HBP medication, female sex, age between 60 and 80 years, menopause without hormone replacement therapy, body mass index (BMI) <30 and no smoking habit. Exclusion criteria were: deficit in cognitive function, smoking habit, medical diagnosis of lung diseases, heart failure, unstable angina, recent myocardial infarction, severe aortic stenosis or mitral regurgitation, aortic aneurysm, recent embolism, active myocarditis or pericarditis, and inability to perform the functional tests. All subjects were informed of the nature and purpose of the study and signed a consent form. This research was conducted in accordance with resolution 196/96 of the National Health Council and was reviewed and approved by the Research Ethics Committee of Universidade Federal do Rio Grande do Norte (protocol 129-2007).

Procedure

The evaluation of each subject was performed in a single day. First, the subjects filled in a form providing their personal data, pathological history and smoking, drinking and physical activity habits. After that, the blood pressure (BP)¹⁹ was measured. Next, the subjects underwent the 2MST, then the TUG test, and finally the 6MWT, with a 10-minute interval between tests. BP was measured after each test for each subject. The tests were carried out as established by Jones and Rikli¹³.

The 2MST measures the maximum number of knee raises that the individual can perform in 2 minutes. At the signal, the subject began the stationary gait (without running), performing as many knee raises as possible in two minutes. The minimum

knee height taken at each step, was established at a midpoint between the patella and the anterior superior iliac spine. The assessor counted the number of right knee raises, while helping in case of loss of balance. The subjects were advised when the first minute was up and when they had 30 seconds left to complete the test.

The TUG test quantifies the time needed to travel 3 meters. The subject was instructed to get up from the chair at the signal, walk to a marker, go around it, return to the chair and sit down as quickly as possible. The subject began the test in a seated position with erect posture, hands on thighs and feet flat on the floor. The subject was reminded that this was a timed test and that the goal was to walk as quickly as possible (without running).

The 6MWT assesses the maximum distance covered in six minutes along a 45.70m path. At the signal, the subject walked as quickly as possible (without running) along the path, as many times as possible within the 6-minute timeframe.

Table 1. Absolute and relative frequencies of the health characteristics of the sample.

	n	%
Comorbidities		
None	6	18.7
Heart disease (Angina/ arrhythmia)	9	28.1
Dyslipidemia	18	56.2
Diabetes	8	25.0
Kidney failure (KF)	2	6.2
Medications		
None	1	3.1
1	14	43.8
2	12	37.5
3 or more	5	15.6
Physical Activity		
Yes	20	62.5
No	12	37.5

Table 2. The 6MWT, 2MST and TUG test results.

	Mean	SD
2MST (number of steps)	62.7	20.2
TUG (seconds)	9.0	2.0
6MWT (meters)	428.0	84.8

6MWT: 6-minute walk test; 2MST: 2-minute step test; TUG: "Timed Up and Go" test. SD: Standard deviation.

Table 3. Relationship between the 6MWT, 2MST and TUG test (Pearson's r).

	r	p
6MWT and 2MST	0.36	0.04
6MWT and TUG	-0.59	0.000
2MST and TUG	-0.66	0.000

6MWT: 6-minute walk test; 2MST: 2-minute step test; TUG: "Timed Up and Go" test.

Statistical analysis

We used absolute and relative frequency distribution for categorical variables and means with standard deviation for continuous variables. Data normality was confirmed using the Kolmogorov-Smirnov test (KS). Pearson's correlation test was used to investigate the correlation between the 6MWT, 2MST and TUG test. Data were analyzed using the statistical software Statistical Package for Social Science (SPSS version 15.0). Significance levels were set at $p < 0.05$ and confidence interval (CI) at 95%.

Results

The sample consisted of 32 hypertensive women with a mean age of 65.4 ± 5.4 years old, $BMI = 26.1 \pm 0.06$ kg/m², time of hypertension diagnosis of 17.7 ± 9.2 years, and treatment duration of 12.8 ± 5.3 years. The women used HBP medication, mostly propranolol, captopril, furosemide, nifedipine, hydrochlorothiazide and atenolol. The amount of medication varied according to disease severity. Table 1 describes the amount of medication taken, the diseases associated with HBP and the physical exercise habits (performed at least 3 times a week for a minimum of 30 minutes and a maximum of 1 hour). All subjects were following a low-sodium, low-fat and low-calorie diet, according to medical recommendations, and they did not consume alcohol.

All subjects completed the tests that evaluate functional capacity for locomotion without complications. Test performance results are shown in Table 2. Data analysis showed a low-to-moderate positive correlation between the 6MWT and the 2MST ($p = 0.04$), a moderate negative correlation between the 6MWT and the TUG test ($p = 0.000$) and a moderate-to-strong negative correlation between the 2MST and the TUG test ($p = 0.000$) (Table 3).

Discussion

The results of the present study are in agreement with other studies^{13,20,21} that found a correlation between different evaluation tests of aerobic capacity. We found a correlation between the 6MWT and 2MST, which shows that both tests yielded similar results for aerobic endurance. Therefore, it can be stated that the 2MST is an alternative to the 6MWT in hypertensive women as well as healthy older adults, as stated by Jones and Rikli¹³.

The 2MST would be a good alternative in situations where a quick test is needed and when there is little room for testing,

making it ideal for clinical practice. It is also suitable for individuals who use orthopedic devices to walk, people with difficulties associated with maintenance of balance²² and even for patients with severe chronic obstructive pulmonary disease. For these patients, the 6MWT can be regarded as a “near maximal” test because energy expenditure during the test comes close to the maximum, according to individual symptoms^{23,24}.

The analysis of the TUG test and the two evaluation tests for aerobic capacity showed an inverse relationship, thus it can be concluded that older hypertensive women with longer TUG test performance times cover a shorter distance in the 6MWT and take fewer steps in the 2MST; and those with shorter TUG test performance times cover a greater distance in the 6MWT and take more steps in the 2MST. These results suggest that, in older hypertensive women, there is an intrinsic relationship between cardiovascular endurance and functional mobility and that, with less cardiovascular endurance, there is a poor functional mobility and vice versa. These findings are corroborated by Chandler²⁵, who stated that endurance influences the ability to answer effectively to a balance disturbance, which is associated with mobility.

Studies show that poor mobility and decreased aerobic capacity are predictors of morbidity and mortality. Changes in mobility predict loss of independence and death in individuals over 65 years of age; individuals with mobility changes have a higher risk of death and dependency than those who have preserved mobility²⁶. Similarly, low levels of cardiorespiratory fitness

have been associated with risk of morbidity and mortality due to chronic degenerative diseases, including coronary artery disease, HBP, diabetes mellitus and some types of cancer²⁷.

Mobility is an extremely important component of physical function as well as a prerequisite in ADL performance and maintaining independence²⁸. Supporting the results found in the present research, Rantanen et al.²⁹ argued that, as functional mobility decreases, activities require more muscular work, increasing energy expenditure; thus, older adults use more energy to walk, contributing to the decline in motor and cardiovascular function.

The relationship between the studied tests is a very important finding because the 6MWT, 2MST and TUG test are being widely used to evaluate the functional capacity of older adults in research around the world, although, for the hypertensive population, these studies are still very rare.

The results of the present study show that the 6MWT can be replaced by the 2MST in the hypertensive population just as in general older adult population. The 2MST can also be used to assess aerobic capacity. The association between the 6MWT, the 2MST and the TUG test allows the recommendation of the TUG test to patients with contraindications³⁰ to evaluation tests for cardiorespiratory endurance. It also allows the measurement of the patient's cardiovascular condition through a fast and effective instrument in the evaluation and monitoring of clinical treatments and exercise programs for this population.

References

1. Farinati PTV. Avaliação da autonomia do idoso: definição de critérios para uma abordagem positiva a partir de um modelo de interação saúde-autonomia. *Arq Geriatr Geront.* 1997;1(1):31-7.
2. Bocalini DS, dos Santos L, Serra AJ. Physical exercise improves the functional capacity and quality of life in patients with heart failure. *Clinics.* 2008;63(4):437-42.
3. Saglam M, Arıkan H, Savcı S, Inal-Ince D, Bosnak-Guclu M, Degirmence B, et al. Relationship between respiratory muscle strength, functional capacity and quality of life in pre-operative cardiac surgery patients. *Europ Respir Rev.* 2008;17:39-40.
4. Pires SR, Oliveira AC, Parreira VF, Britto RR. Teste de caminhada de seis minutos em diferentes faixas etárias e índices de massa corporal. *Rev Bras Fisioter.* 2007;11(2):147-51.
5. Steffen TM, Hacker TA, Mollinger L. Age-and gender-related test performance in community-dwelling elderly people: six-minute walk test, berg balance scale, timed up & go test, and gait speeds. *Phys Ther.* 2002;82(2):128-37.
6. Enright PL. The six-minute walk test. *Respir Care.* 2003;48(8):783-5.
7. Lima-Costa MF, Barreto SM, Giatti L. Condições de saúde, capacidade funcional, uso de serviços de saúde e gastos com medicamentos da população brasileira: um estudo descritivo baseado na Pesquisa nacional por Amostra de Domicílios. *Cad Saúde Pública.* 2003;19(3):735-43.
8. Hajjar I, Lackland DT, Cupples LA, Lipsitz LA. Association between concurrent and remote blood pressure and disability in older adults. *Hypertension.* 2007;50(6):1026-32.
9. Alves LC, Leimann BCQ, Vasconcelos MEL, Carvalho MS, Vasconcelos AGG, Fonseca TCO, et al. A influência das doenças crônicas na capacidade funcional dos idosos do Município de São Paulo, Brasil. *Cad Saúde Pública.* 2007;23(8):1924-30.
10. Gregg EW, Mangione CM, Cauley JA, Thompson TJ, Schwartz AV, Ensrud KE, et al. Diabetes and incidence of functional disability in older women. *Diabetes Care.* 2002;25(1):61-7.
11. Wind H, Gouttebauge V, Kuijjer PP, Sluiter JK, Frings-Dresen MH. The utility of functional capacity evaluation: the opinion of physicians and other experts in the field of return to work and disability claims. *Int Arch Occup Environ Health.* 2006;79(6):528-34.
12. Andreotti RA, Okuma SS. Validação de uma bateria de testes de atividades da vida diária para idosos fisicamente independentes. *Rev Paul Educ Fís.* 1999;13(1):46-66.

13. Jones CJ, Rikli RE. Measuring functional. *The Journal on Active Aging*. 2002;1:24-30.
14. Rikli RE, Jones CJ. Development and validation of a functional fitness test for community-residing older adults. *J Aging Phys Act*. 1999;7:129-61.
15. Taylor-Piliae RE, Haskell WL, Froelicher ES. Hemodynamic responses to a community-based Tai Chi exercise intervention in ethnic Chinese adults with cardiovascular disease risk factors. *Eur J Cardiovasc Nurs*. 2006;5(2):165-74.
16. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc*. 1991;39(2):142-8.
17. Mendonça TT, Ito RE, Bartholomeu T, Tinucci T, Forjaz CLM. Risco cardiovascular, aptidão física e prática de atividade física de idosos de um parque de São Paulo. *Revista Brasileira de Ciência e Movimento*. 2004;12(2):57-62.
18. Cho BL, Scarpace D, Alexander NB. Tests of stepping as indicators of mobility, balance, and fall risk in balance-impaired older adults. *J Am Geriatr Soc*. 2004;52(7):1168-73.
19. IV Brazilian Guidelines on Arterial Hypertension Work Groups. IV Brazilian Guidelines on Arterial Hypertension. *Arq Bras Cardiol*. 2004;82 Suppl 4: S7-22.
20. Dugas EW. The development and validation of a 2-minute step test to estimate aerobic endurance in older adults [dissertation]. Fullerton (CA): California State University; 1996.
21. Johnston J. Validation of a 2-minute step-in-place test to treadmill performance in older adults [dissertation]. Fullerton (CA): California State University; 1998.
22. Rózańska-Kirschke A, Kocur P, Wilk M, Dylewicz P. The fullerton fitness test as an index of fitness in the elderly. *Medical Rehabilitation*. 2006;10(2): 9-16.
23. Nishiyama O, Taniguchi H, Kondoh Y, Kimura T, Kato K, Ogawa T, et al. Dyspnoea at 6-min walk test in idiopathic pulmonary fibrosis: comparison with COPD. *Respir Med*. 2007;101(4):833-8.
24. Troosters T, Vilaro J, Rabinovich R, Casas A, Barberà JA, Rodríguez-Roisin R, et al. Physiological responses to the 6-min walk test in patients with chronic obstructive pulmonary disease. *Eur Respir J*. 2002;20(3):564-9.
25. Chandler JM. Balance and falls in the elderly: issues in evaluation and treatment. In: Guccione AA, editor. *Geriatric Physical Therapy*. 2^a ed. Alexandria: Mosby; 2000. p. 280-92.
26. Matsudo SM. Atividade física na promoção da saúde e qualidade de vida no envelhecimento. *Rev Bras Educ Fis Esp*. 2006;20 Suppl 5:S135-7.
27. Maranhão Neto GA, Farinatti PTV. Equações de predição da aptidão cardiorrespiratória sem testes de exercício e sua aplicabilidade em estudos epidemiológicos: revisão descritiva e análise dos estudos. *Rev Bras Med Esporte*. 2003;9(5):304-14.
28. Oliveira DLC, Goretti LC, Pereira LSM. O desempenho de idosos institucionalizados com alterações cognitivas em atividades de vida diária e mobilidade: estudo piloto. *Rev Bras Fisioter*. 2006;10(1):91-6.
29. Rantanen T, Guralnik JM, Sakari-Rantala R, Leveille S, Simonsick EM, Ling S, et al. Disability, physical activity, and muscle strength in older women: the women's health and aging study. *Arch Phys Med Rehabil*. 1999;80(2):130-5.
30. Neder JA, Nery LE. Teste de exercício cardiopulmonar. *J Bras Pneumol*. 2002;28 Suppl 3:S166-206.