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Association between physical and cognitive function in post menopause: a cross-sectional study

Associação entre função física e cognitiva na pós-menopausa: um estudo transversal

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ABSTRACT

Functional tests have been performed to predict cognitive decline in postmenopausal women and may be an important tool to identify early reductions in cognitive performance in this population. However, it is still unclear which functional test is more sensitive for detecting cognitive decline in the investigated sample. The aim of this study was to verify the association between functional performance and cognitive function in postmenopausal women and to analyze whether the gait speed of 400 meters (400wt) and Timed Up and Go (TUG) tests are predictors of cognitive function in this sample. One hundred and twenty-eight postmenopausal women (60.8 ± 7.9 years) participated in this cross-sectional study. Body composition was assessed using Dual Energy X-ray Absorptiometry (DXA), functional performance by the TUG and 400wt tests, cognitive performance by the Montreal Cognitive Assessment (MoCA) test and muscle strength by maximum voluntary isometric contraction (MVIC) in lower limbs. An association between functional performance and cognitive function was observed in middle-aged postmenopausal women. The TUG test was associated with the MoCA test (B = -0.79; SE = 0.29; p = 0.008). However, no association was observed between 400wt with the MoCA test (B = 3.03; SE = 1.92; p = 0.117). These results show that the TUG test is a good predictor of cognitive decline in postmenopausal middle-aged women.

Keywords: Physical Functional Performance; Cognitive impairment; Aging.

RESUMO

Testes funcionais têm sido realizados para predizer declínio cognitivo em mulheres na pós-menopausa e podem ser uma ferramenta importante para identificar reduções precoces no desempenho cognitivo nessa população. No entanto, ainda não está claro qual teste funcional é mais sensível para detectar precocemente o declínio cognitivo na amostra investigada. O objetivo deste estudo foi verificar se há associação entre desempenho funcional e função cognitiva em mulheres na pós-menopausa e analisar se os testes de velocidade de marcha de 400 metros (Vm400) e Timed Up and Go (TUG) são preditores da função cognitiva nesta amostra. Cento e vinte oito mulheres na pós-menopausa (60,8 ± 7,9 anos) participaram deste estudo de carácter transversal. A composição corporal foi avaliada pela Absorciometria Radiológica de Dupla Energia (DXA), desempenho funcional pelos testes Vm400 e TUG, desempenho cognitivo pelo teste Montreal Cognitive Assessment (MoCA) e força muscular pela contração isométrica voluntaria máxima (CIVM) dos membros inferiores. Uma associação entre desempenho funcional e função cognitiva foi observada na amostra investigada. O teste TUG foi associado ao teste MoCA (B = -0,79; SE = 0,29; p = 0,008). No entanto, não foi observada associação entre Vm400 com o teste MoCA (B = 3,03; SE = 1,92; p = 0,117). Esses resultados mostram que o teste TUG é um bom preditor de declínio cognitivo em mulheres na pós-menopausa na meia idade.

Palavras-chave: *Desempenho físico funcional; Declínio cognitivo; Envelhecimento.*

Introduction

Physiological changes are evident in postmenopausal women, such as increased adipose tissue, and decreased skeletal muscle mass[1–3]. These and others alterations can interfere with functional performance as changes in walking speed may predispose an important risk of falls, fractures and functional dependence[4–6]. Besides that, postmenopausal women may experience a decline in cognitive skills in their daily lives. The most common symptoms are a lack of attention, low processing speed and memory[7–9]. A decrease in functional performance and cognitive function may lead to poor quality of life in postmenopausal women[1,4–6,10].

Some studies have shown the association between functional performance and cognitive function in a population of both sexes above 70 years old[10–14]. Moreover, there are studies reporting that low physical function can predict low cognitive function in both sexes[11,13,15]. Thus, Buracchio et al.[11] observed that the functional decline precedes cognitive decline by up to 12 years, and that this conversion occurred at 89 years old in this sample. Therefore, it is known that physiological changes already started around the age of 50 as a reduction in muscle mass[1]. This is a factor that influences functional performance[16] making it important to investigate this functional and cognitive relationship in middle-aged individuals (above 50 years old). In addition, another aspect to be considered about aging is the difference between the sexes. There are differences between men and women regarding hormonal variations, mainly witnessed by postmenopausal women[17].

Both the Timed Up and Go (TUG) test and gait speed have shown to be good tools for assessing physical function, showing a correlation with cognitive decline in the elderly[11–13,15,18]. Considering this, the TUG test has been associated with global cognitive function and its domains[12,15]. Therefore, functional performance assessed by the TUG test can be a tool to detect changes in mobility impairment of cognitive function in men and women[15]. Hoogendijk et al.[13] showed that in populations of both sexes with an average age above 70 years, with low speed, in a gait speed test, can predict cognitive decline. However, changes in cognitive function may be detected early to allow a preventive treatment of this decline. Thus, it is important to verify this relationship between functional performance and cognitive function in more specific populations, such as women, especially in younger older women (for example, 60 years old). Given this information, it is important to identify whether these functional performance tests can predict cognitive decline in early postmenopausal women. Thus, these specific tests can be used to assess functional performance and its relationship with cognition in postmenopausal women, so that patients with potential risks of cognitive loss, or low function, can be identified and prevention strategies in this context can be outlined.

Therefore, considering the above, we believe that there is an association between functional performance and cognitive function in postmenopausal women aged 60 years. Thus, the aim of the present study is to verify the association of functional performance and cognitive function in postmenopausal women. The secondary aim is to analyze whether gait speed tests of 400 meters (400wt) and TUG are predictors of cognitive function in postmenopausal women.

Methods

The present study was approved by the Research Ethics Committee at the Federal University of Triângulo Mineiro (UFTM), CAAE (n° 85052218.0.0000.51.54). All procedures were conducted in accordance with the Declaration of Helsinki and resolution n° 466/2022 of the National Health Council.

The sample size was calculated using G*Power software (version 3.1.9.2). The coefficient of determination (R^2) was set at 9% (the percentage of variability in the outcome variable that can be explained by the predictor variables). The effect size f^2 generated by G*Power was 0.0989. The alpha error was defined as 0.05 with a power of 80%. The power analysis demonstrated that at least 115 participants are needed to detect R^2 of 9% (effect size f^2 = 0.0989, test family f, linear multiple regression). This is an analytical cross-sectional study with 128 women participants aged 40-85 years. Recruitment was done by phone call using a registration list in the Research Applied Physiology, Nutrition and Exercise Group (PHYNERgroup) at the Postgraduate Program in Physical Education at the Federal University of Triângulo Mineiro (PPGEF/UFTM). Data collection was carried out from 4th to 8th February, 2019. A free and informed consent form was then given to the participants. Inclusion criteria consisted of: amenorrhea at least 12 months before the study started; not having undergone hormone replacement therapy or phytoestrogens; non-drinkers (no alcohol in their diet); non-smokers; not having practiced resistance training for less than 6 months until the start of the evaluations; absence of neurological diseases; absence of muscular; thromboembolic and gastrointestinal disorders; absence of infectious diseases, not having a history of cancer, liver disease or cardiorespiratory diseases; not having uncontrolled hypertension (SBP ≥160 mmHg and DBP ≥120 mmHg); not having another disease that does not allow carrying out the exercises used in the evaluations. The exclusion criteria included: impossibility of contacting the volunteer to schedule the evaluations; abandonment of any of the stages of the evaluations without a specified cause or due to the appearance of some illness or disability during the course of the evaluations. The flowchart of the participants is shown in Figure 1.

The volunteers visited the laboratory three times with a 24 – 48 hours interval in between them. On the first visit, the functional and cognitive tests were performed; on the second visit body composition assessment was carried out; and on the third visit, questionnaires were distributed, and maximum voluntary isometric contraction (MVIC) was performed. It is important to note that for each test there were qualified professionals.

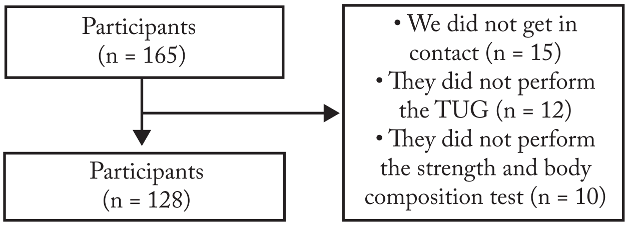

Figure 1 – Study flowchart.

The TUG test was used to analyze functional performance. The test was performed in an indoor straight, flat, well-lit place. The test started with the volunteers seated. After a standardized command "Go", they had to get up from the chair without using their arms, walk three meters, go around a cone and return to the starting position, as quickly as possible. The test time was measured in seconds (s). The test was repeated twice, and was considered the shortest time recorded[19].

The 400wt was performed on a running block with a 106 m perimeter. A starting line, which indicated the beginning and end of the 106 m at each lap, was marked on the floor using colored tape. All volunteers were stimulated (verbal stimuli, "you can go further", "walk as fast as you can") throughout the duration of the walk test. In addition, all volunteers were previously instructed to walk as fast as possible without breaks during the test. After completing 400 m, the time was recorded, and the velocity was calculated in meters per second and used for statistical analysis[20].

To analyze the cognitive function, the Montreal Cognitive Assessment (MoCA) test was used (https://www.mocatest.org/). The test was carried out in a quiet room, with a controlled temperature at 24°C. The evaluation consists of a one-page protocol, whose application time is approximately 10 minutes. It evaluates eight cognitive domains where several items are included: 1. Memory (Deferred Word Evocation - 5 minutes); 2. Visuo-spatial capacity (Clock Design and Cube Copy); 3. Executive Function (Trail Making Test B, Phonemic Fluency and Verbal Abstraction); 4. Language (Nomination of 3 unfamiliar animals, repetition of 2 syntactically complex sentences and Phonemic Fluency); 5. Orientation (Temporal and Spatial); 6. Attention, Concentration and Working Memory (Digit memory [forward direction]; 7. Digit memory [reverse direction], Sustained Attention Task [target detection] and 8. Subtraction in a series of 7. The MoCA score ranges from 0 to 30 points and the higher the score, the more favorable the result [21]. The MoCA test was applied by a certified professional (#BRLINAN83978-01).

Body mass was quantified using a digital scale (Hbf 214 Omron®) and the height was measured by a portable stadiometer (AVANUTRI®, Brazil). The Body Mass Index (BMI) was calculated by the body mass/height^2 ratio (kg/m^2). To assess the muscle mass (kg), appendicular lean mass (ALM, kg), body fat percentage (%), the Dual Energy X-ray Absorptometry was used [DXA (GE / Lunar iDXACorp, Madison, USA)] and quantified using the enCORE software platform (version 14.10). For the DXA exam, the participants were instructed to equalize the hydration, drinking at least 2 liters of water for 24 hours the previous day and fast completely from 8am to 10am. They were also instructed to wear light clothing without any metallic objects and to go to the bathroom before the test.

The maximum voluntary isometric contraction (MVIC) test evaluates the force/torque in kgf. Torque was calculated by the product of the force (force applied in kgf multiplied by gravity) by the lever arm (length of the volunteer's leg). For the MVIC collection of the muscular strength of the lower limbs, the volunteers were positioned seated in a chair, with their back supported, well fixed with a belt, knee and hip at 90°, with a load cell attached to the chair level of the ankle, so that when extending the knee (right) the volunteer performed a traction in the load cell. The force used to pull was captured by the Miotecsuit software. First, the volunteers performed a warm-up with 24 submaximal isometric contractions, after a minute of rest, they performed three five-second MVICs, separated by a 30-second rest between them. The best peak value among the three MVICs was used to calculate the torque[22].

To assess the level of physical activity and the time spent in the sitting position, the long version of the International Physical Activity Questionnaire (IPAQ) was used. This population instrument was estimated in time of daily and weekly activities, in physical activities of strength, valid domestic tools and instruments, as an estimate of time of daily activities: work, different situations in transport and leisure, that is, presented in the sitting position. A unit of measurement used to account for total physical activity in minutes/week[23].

All analyses were performed using SPSS software (version 23.0, IBM Corp, New York, NY, USA). The Shapiro-Wilk test was performed to verify the distribution of normality and the Levene test to identify the homoscedasticity of all study variables. For descriptive analyses, the results were expressed as mean and ±

standard deviation of the mean, minimum, and maximum. Pearson's correlation was performed to verify the correlation between the MoCA and TUG, 400wt, MVIC, Age, BMI, ALM, Fat%, ST and PA. Two separate linear regression models were built to compare the linear relationship of the TUG and 400wt to predict MoCA. For this last analysis, TUG and 400wt were adjusted for age and MVIC. Significance was accepted when the p-value was <0.05. All values are described as means and Wald 95% confidence intervals.

Results

Table 1 shows sample characteristics. The participants were on average aged 60.8 years old. The sample had two participants over 80 years old and another 10 over 70 years old. However, most of the volunteers were between 50 and 60 years old, and this age group was the one that has the largest representation of the sample. The mean of BMI was 27.30 ± 5.36 kg/m^2, which indicates being overweight. The sample contains only three volunteers with a BMI greater than 40kg/m^2. The functional performance was observed using the TUG test, in the mean of 7.30 s, for the test of 400wt 1.68 m/s, and MVIC of 86.10 kg. A cognitive decline was observed in the sample evaluated, with an average MoCA score of approximately 22.

Table 2 shows Pearson's correlation analysis. The outcome variable MoCA has a negative association with the TUG test ($r = -0.37$; $p = 0.001$), and a positive association with 400wt ($r = 0.29$; $p = 0.001$), indicating that a better performance in the TUG and 400wt tests associates with a better performance in MoCA. The MoCA was also negatively associated with age ($r = -0.35$; $p = 0.00$) and had a positive correlation with MVIC ($r = 0.24$; $p = 0.006$). This shows an inverse relationship between age and MoCA and a direct relationship with lower limb strength. However, MoCA did not have a significant association with body composition variables such as BMI ($r = -0.10$; $p = 0.261$), ALM ($r = -0.00$; $p = 0.980$) and fat % ($r = -0.08$; $p = 0.364$). In the same sense, MoCA did not associate with the level of physical activity ($r = 0.06$; $p = 0.472$) or sitting time ($r = -0.06$; $p = 0.477$).

Table 3 shows the capacity of linear relationship between the variables TUG and MoCA. It was observed that TUG has an association with MoCA (Table 2). Therefore, we used TUG as a predictor variable for MoCA. The TUG obtained a linear relationship with MoCA even when adjusted for age and MVIC ($p = 0.008$), thus removing the effect of age and lower limb strength from this relationship. It was observed that in the confidence interval (CI) of the estimate (Lower = –1.38; Upper = –0.21), within a 95% CI, there is a negative relationship between TUG and MoCA.

Table 4 also shows the linear relationship capacity, between the variables 400wt and MoCA. It was observed that 400wt has a correlation with MoCA (Table 2). Therefore, we used 400wt as a predictor variable for MoCA. However, 400wt had no linear relationship with MoCA when adjusted for age and MVIC ($p = 0.117$).

Table 5 shows the ability of a linear relationship between the variables TUG and MoCA in two models: model A aged ≤65 years and B aged >65years. Thus, it was observed that in model A, the TUG test was associated with the MoCA test, even adjusted for age and lower limb strength. In model B there was no significant association between the TUG test and MoCA test, meanwhile there was a trend ($p < 0.07$).

Table 1 – Sample characteristics (n = 128).

	Mean	SD	IC95%	Minimum	Maximum
Age (years)	60.80	7.94	59.37; 62.15	42.00	85.00
BMI (kg/m^2)	27.90	5.36	26.94; 28.82	18.10	47.00
ALM (kg)	17.30	3.07	16.79; 17.86	10.10	26.10
Fat (%)	43.10	5.59	42.14; 44.10	29.30	55.90
MoCA (Score)	22.00	4.18	21.23; 22.69	9.00	29.00
MVIC (kg)	86.10	27.30	81.28; 90.82	33.10	155
TUG (s)	7.30	1.34	7.07; 7.54	5.28	13.70
400wt (m/s)	1.68	0.21	1.64; 1.72	0.98	2.13
PA (min/week)	458	459	377.46; 537.88	0.00	2.520
ST (min/week)	3.928	1.702	3.630.19; 4.225.67	630	8.400

BMI = body mass index; Kg = kilogram; % = percentage; ALM = appendicular lean mass; MVIC = maximum voluntary isometric contraction; TUG test = Time Up and Go test; 400wt = walk test 400 meters; m/s = meters per second; PA = physical activity; ST = sitting time; n. number; SD = standard deviation.

Table 2 – Correlation between the study variables.

		MoCA	Age	BMI	ALM	Fat %	Level PA	ST	MVIC	TUG
MoCA	r-valor									
	p-valor									
Age	r-valor	-0.353***								
	p-valor	0.001								
BMI	r-valor	-0.100	-0.257**							
	p-valor	0.261	0.003							
ALM	r-valor	0.002	-0.263**	0.780***						
	p-valor	0.980	0.003	0.001						
Fat %	r-valor	-0.081	-0.205*	0.745***	0.374***					
	p-valor	0.364	0.020	0.001	0.001					
Level PA	r-valor	0.064	-0.279**	-0.082	0.057	-0.030				
	p-valor	0.472	0.001	0.355	0.522	0.740				
ST	r-valor	-0.063	0.037	0.312***	0.241**	0.239**	-0.394***			
	p-valor	0.477	0.678	0.001	0.006	0.006	0.001			
MVIC	r-valor	0.243**	-0.270**	0.108	0.311***	-0.035	0.254**	-0.102		
	p-valor	0.006	0.002	0.224	0.001	0.693	0.004	0.250		
TUG	r-valor	-0.379***	0.401***	0.153	-0.005	0.104	-0.171	0.172	-0.420***	
	p-valor	0.001	0.001	0.085	0.955	0.243	0.053	0.052	0.001	
400wt (n=122)	r-valor	0.297***	-0.392***	-0.193*	-0.004	-0.207*	0.160	-0.162	0.416***	-0.761***
	p-valor	0.001	0.001	0.033	0.964	0.022	0.079	0.075	0.001	0.001

BMI = body mass index; ALM = appendicular lean mass; MVIC = maximum voluntary isometric contraction; % = percentage; 400wt = walk test 400 meters; m/s = meters per second; TUG test = Time Up and Go test; PA = physical activity; ST = sitting time. Note. * p <.05. ** p <.01. *** p <.001.

Table 3 – Linear regression to check TUG sensitivity for predicting cognitive function (n = 128).

			CI 95%			
Predictor	B	SE	Lower	Upper	t	p
Intercept	34.188	3.567	27.127	41.250	9.583	<0.001
TUG	-0.798	0.293	-1.380	-0.217	-2.718	0.008
Age	-0.121	0.046	-0.213	-0.028	-2.600	0.010
MVIC	0.011	0.013	-0.015	0.038	0.818	0.415

MVIC = maximum voluntary isometric contraction; TUG test = Time Up and Go test; SE = standard error; R2 = 19.6%; statistical significance p < 0.05.

Table 4 – Linear regression to check the sensitivity of 400wt to predict cognitive function (n = 122).

			CI 95%			
Predictor	B	SE	Lower	Upper	t	p
Intercept	22.437	4.988	12.559	32.315	4.50	<0.001
400wt	3.036	1.924	-0.774	6.847	1.58	0.117
Age	-0.118	0.048	-0.215	-0.022	-2.43	0.016
MVIC	0.018	0.014	-0.009	0.046	1.33	0.187

MVIC = maximum voluntary isometric contraction; 400wt = walk test 400 meters; m/s = meters per second; SE = standard error; R2 = 14.8%. statistical significance p < 0.05.

Table 5 –Linear regression to check TUG sensitivity for predicting cognitive function in model A age ≤65 (n = 96) and model B age >65 (n = 32).

			CI 95%			
Predictor	B	SE	Lower	Upper	t	p
(A)	0.061	0.080	-0.098	0.220	0.762	0.448
MoCA	27.012	5.184	16.716	37.307	5.211	<0.001
TUG	-0.707	0.337	-1.478	-0.065	-1.876	0.071
MVIC	-1.231	0.419	-2.063	-0.400	-2.941	0.004
(B)	-0.598	0.133	-0.871	-0.326	-4.493	<0.001
MoCA	67.941	11.078	45.248	90.634	6.133	<0.001
TUG	-0.707	0.377	-1.478	0.065	-1.876	0.071
MVIC	0.005	0.031	-0.059	0.069	0.171	0.865

MVIC = maximum voluntary isometric contraction; TUG test = Time Up and Go test; SE = standard error. Model A: R2 = 12.4%; Model B: R2 = 47.8%; statistical significance p < 0.05.

Discussion

The present study aimed to verify whether an association between functional performance and cognitive function occurs in postmenopausal women. In addition, the objective was also to verify the association between the TUG test and 400wt with the cognitive function in postmenopausal women. As a main result, it was found that there is an association between functional performance and cognitive function in postmenopausal women. Furthermore, it was found that the TUG can predict cognitive decline in this population, but the 400wt cannot do this.

Some studies have investigated the relationship between functional performance and cognitive function, both in men and women, and have observed that such a relationship exists[10–13,15]. Buracchio et al.[11] compared the trajectory of functional decline measured by walking speed for 20 years among elderly people who developed cognitive decline and observed that the decline in gait speed can appear up to 12 years before cognitive decline. The authors also observed that conversion to the decline of cognitive impairment occurs at an average age of 89 years. Thus, as in our study, an association was found between the functional performance of the TUG and 400wt with cognitive function in postmenopausal women with an average age of 60 years. In view of our findings, we observed that this relationship between functional performance and cognitive function occurs early in women in the postmenopausal period. Therefore, assessing and intervening early in the functional performance of postmenopausal women is essential to maintain and preserve cognitive function in aging.

Studies show evidence that gait speed is associated with cognitive function among the elderly[11,13,18]. In a recent meta-analysis carried out by Handing et al.[18], the authors compared the gait speed test, 4 meters and 400 meters with cognitive decline. An association was observed between a reduction in gait speed with a cognitive decline in the elderly with a mean age of 71 years for both sexes, suggesting that gait speed tests may be a marker of cognitive decline in the elderly aged 70 years old and over. In our study, there was a correlation between gait speed and cognitive decline. However, when only one adjusts for age and strength of lower limbs, this relationship loses effect. Thus, it is evident that age is a determining factor for tests that assess gait speed. Therefore, our results show that gait speed as an assessment tool for cognitive decline women at ages below 70 years seems not to be effective.

Regarding the functional performance, analyzed by the TUG test, studies have shown an association between functional performance and global cognitive function and its domains, especially the executive function[12,15,24]. Our findings reinforce studies in the literature on the association between functional performance and cognition. They also show that this association can be observed in young postmenopausal women. When divided into two groups, one group was aged ≤65 years and the other group aged >65 years. In the group ≤65 years the TUG test continues have predictive ability for cognitive function, and in the group >65 years, no significance was found ($p < 0.07$). However, the sample size of this group was relatively small ($n = 32$), which can lead to a type 2 error in the statistical model. In the present study, the TUG test proved to be a suitable tool to observe a possible cognitive decline, which maintains the predictive effect even when adjusted for age and strength of the lower limbs. This result is due to the TUG being a test consisting of multiple components of mobility such as lifting, walking, turning and sitting[12,24,25]. Kawagoe et al.[26] show that they found a relationship between visually coded working memory by activating the frontal regions of the brain by magnetic resonance with the TUG test, but not walking. Therefore, our results show that the TUG test is a better predictor of cognitive function in postmenopausal women than 400wt, regardless of age and lower limb strength.

By assessing changes in both gait and mobility assessed by the TUG, changes in cognitive function can also be observed[11,13,15,24]. Thus, we can observe that gait speed requires interaction of attention, visuospatial function and attention, activating areas such as a smaller volume of the right hippocampus[27]. Likewise, TUG also requires interaction, but TUG is a more complex test than the gait speed which may require using the executive function and memory[12,15,24]. Thus, worse TUG performance was associated with severe atrophy of bilateral, right and left medial temporal areas, in addition to activating areas, such as the prefrontal cortex[28,29]. Therefore, the complexity of TUG in relation to gait speed may be associated with the result found in the present study, which shows TUG as a tool with a predictive power greater than 400wt.

In the current study, both TUG and 400wt tests were not associated with the PA level or ST. In the same way, in the study by Izawa et al[30], no association was observed between the functional performance and PA level in older adults of both sexes. The fact that the

PA level is not associated with functional performance and cognitive function may have been a result of the sample size was not sufficient to detect an association between these variables.

This study had some limitations. First, the study was conducted with Brazilian participants, therefore, a generalization to other populations should be carried out with caution. Second, it was not considered for the analysis of the socioeconomic and cultural situation of the participants, as well as barriers and social facilitators such as living in a situation of dependence and being responsible for family members or the number of people in the same family environment. Despite the limitations mentioned, the main strength of our study is the adjustment of age and strength of lower limbs both for 400wt and for TUG, which allows an ideal forecast of cognitive decline in postmenopausal women. It is important to note that the tests we ran are easy to perform and evaluate.

The results of the present study indicate that the screening carried out using the TUG test can identify women in the early and potentially reversible stage of the process of declining cognitive function. On the other hand, the same result was not observed in relation to the 400wt, indicating that the TUG test has a better ability to predict early cognitive decline in postmenopausal women. Thus, we conclude that functional performance is associated with the decline in cognitive function in postmenopausal women with an average age of 60 years. Furthermore, the TUG test proved to be a useful tool to predict cognitive decline in this population.

Understanding the specific relationship between cognitive function and functional performance is a vital area for the future. However, future studies should carry out a longitudinal analysis, taking into account biopsychosocial factors.

Conflict of interest

The authors declare no conflict of interest.

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Author's contributions

Sousa WG, participated in the initial design of the study, its design, data collection and analysis, preparation of the manuscript, as well as its review. Pelet DCS, collection and analysis of data, preparation of the manuscript, as well as revision of the same. Margato LR, participated in the initial design of the study, its design, data collection and analysis, preparation of the manuscript, as well as its review. De Paula RF, collection and analysis of data, preparation of the manuscript, as well as revision of the same. Orsatti FL, participated in the initial design of the study, its design, statistical analysis, preparation of the manuscript, as well as its review. Lino ADS, study co-orientation, in the initial design of the study, its design, data collection and analysis, preparation of the manuscript, as well as its review. Souza MVC study orientation, in the initial design of the study, its design, data collection and analysis, preparation of the manuscript, as well as its review.

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