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RESEARCH

Gait speed and cognitive score in elderly users of the primary care service

Velocidade da marcha e escore cognitivo em idosos usuários da atenção primária

Velocidad de la marcha y la puntuación cognitiva en personas mayores pacientes de la atención primaria

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ABSTRACT

Objective: to investigate the association between gait speed and the cognitive score of elderly patients enrolled in a Basic Health Unit. **Method:** a quantitative cross-sectional study with 203 elderly, a sample calculated based on the estimated population proportion. Data were collected using a sociodemographic and clinical questionnaire, gait speed test (GS) and the Mini Mental State Examination (MMSE). **Results:** the illiterate patients had a mean MMSE = 19.33(±3.7) and GS = 0.76m/s (±0.3); those with low/medium education had a MMSE = 25.43(±2.8) and GS = 0.92m/s (±0.2); and the elderly with higher education had a MMSE = 27.33(±2.9) and GS = 1.12m/s (±0.3).There was a weak correlation ($R^{2=0.0354}$) between gait speed and cognitive score, with statistical significance (Prob > F = 0.0072) and a positive linear trend. **Conclusion:** the better cognitive score the higher the gait speed; the illiterate elderly were those with lower gait speed, thereby indicating a poorer physical performance.
Key words: Gait; Cognition; Geriatric Nursing.

RESUMO

Objetivo: investigar a associação entre velocidade da marcha e o escore cognitivo de idosos cadastrados em uma Unidade Básica de Saúde. **Método:** estudo quantitativo transversal realizado com amostra calculada de 203 idosos. Os dados foram coletados mediante questionário sociodemográfico e clínico, teste de Velocidade da Marcha (VM) e do Mini exame do Estado Mental (MEEM). **Resultados:** os analfabetos obtiveram média no MEEM = 19,33 (±3,7) e VM = 0.76 m/s (±0,3); os de baixa/média escolaridade MEEM = 25,43 (±2,8) e VM = 0,92 m/s (±0,2); e idosos com ensino superior MEEM = 27,33 (±2,9) e VM = 1,12 m/s (±0,3). Houve correlação fraca ($R^2 = 0,0354$) entre velocidade da marcha e escore cognitivo, com significância estatística (Prob > F = 0,0072) e tendência linear positiva. **Conclusão:** quanto melhor o escore cognitivo, maior a velocidade de marcha, portanto, os idosos analfabetos são os que possuem menor velocidade da marcha, o que indica pior desempenho físico.
Descritores: Marcha; Cognição; Enfermagem Geriátrica.

RESUMEN

Objetivo: investigar la asociación entre la velocidad de la marcha y la puntuación cognitiva de ancianos inscritos en una Unidad Básica de Salud. **Método:** cruza estudio cuantitativo con una muestra de 203 personas mayores, calculado en base a la proporción de la población estimada. Los datos fueron recolectados a través de cuestionario sociodemográfico y clínico, la prueba de velocidad de la marcha (VM) y el Mini Examen del Estado Mental (MMSE). **Resultados:** analfabetos mostró media MMSE = 19,33 (±3,7) y VM = 0,76 m/s (±0,3); la baja/medio de la educación MMSE = 25,43 (±2,8) y VM = 0,92 m/s (±0,2); y las personas mayores con educación superior MMSE = 27.33 (±2,9) y VM = 1,12 m/s (±0,3). Hubo una correlación débil ($R^2 = 0,0354$) entre la velocidad de la marcha y la puntuación cognitiva, con significación estadística (Prob > F = 0.0072) y la tendencia lineal positiva. **Conclusión:** el mejor puntuación cognitiva, mayor será la velocidad de conducción, por lo que los ancianos analfabetos son los que tienen menor velocidad de la marcha, lo que indica el rendimiento físico más pobre.
Palabras clave: Marcha; Cognición; Enfermería Geriatrica.

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INTRODUCTION

Gait is one of the most common human movements, the result of the interaction between the nervous and musculoskeletal systems, by means of energy expenditure, based on body symmetry, balance and postural stability[1]. In the elderly, being able to walk means the maintenance of independence, favoring the performance of daily activities and delaying functional decline and the development of disabilities[2].

Several studies consider clinical assessment of gait as an important indicator of the health of elderly populations[3-5]. It results from the interaction of multiple organ systems that compose a life cycle with a direct effect on health and survival[4,6]. Although there are other parameters related to gait, such as step length and the peak of the pelvic tilt, the analysis of speed has been highlighted in investigations. The evaluation of this component has been considered the sixth vital sign, because it reflects the functioning of multiple organ systems because it aids the disease prognosis[4].

The decrease in gait performance is a common process in aging and is often associated with several adverse health effects, such as weakness[7], falls[8], hospitalizations[3] and poor quality of life[9]. Recognized as a mobility performance measure[10], gait speed has been directly related to cognitive abilities of an individual[11-12] and it is considered an indicator of elderly who are at high risk for cognitive decline[12-14].

Considering the above, the analysis of gait speed and its association with cognitive performance can represent an important factor in assessing the health of the elderly. From this perspective, the objective of this study was to investigate the association between gait speed and the cognitive score of elderly individuals enrolled in a Basic Health Unit.

METHOD

This was a descriptive, cross- sectional study conducted in a Basic Health Unit (BHU) of a capital city in southern Brazil. The target population consisted of elderly individuals awaiting an appointment at the BHU, selected according to the following inclusion criteria: (a) aged more than 60 years; (b) having physical or cognitive disability that makes it impossible to perform the study. The elderly with previous diagnoses of severe mental illnesses and deficits that prevented participation in the study were excluded.

The sample size was determined based on the estimated population proportion. The BHU where the study was conducted has a population of approximately 1050 registered elderly citizens. The confidence level considered was 95% ($\alpha = 0.05$), and a sample error of five percentage points was determined. Because of possibilities of losses and refusals, 10% more were added to the sample size, resulting in a sampling plan consisting of 203 elderly

The sample was recruited in a non probabilistic manner, and individuals were invited to participate in the study according to their arrival to the BHU. Data collection occurred from January to June of 2014. Initially, the Mini Mental State Examination (MMSE) test [15-16] was applied for cognitive assessment. The test contains 11 items, grouped into seven categories, each one with the aim to assess a group of specific cognitive functions: temporal orientation, spatial orientation, immediate memory, attention and calculation, recall of memory, language and visual constructive capacity. The total score ranges from zero to 30.

To evaluate the gait speed, the elderly individual was instructed to walk six meters, in a normal way, on a flat surface, signaled by four marks (one at the beginning, one meter, five meters and end). To reduce the effects of acceleration and deceleration, the test began on the second mark, disrupting the timing of the third mark[6]. The digital timer measured the time in seconds for the route of four meters. Gait speed was calculated in meters per second (m/s) as per an international study on frailty in the elderly[17], in order to perform comparisons.

Sex, age and education were investigated, in order to categorize and characterize the sample. The data were organized and stored in the Excel® 2007 software, after double-checking data entry. To analyze the results, the Epi Info software, version 6.04, was used. Descriptive statistics were applied (distribution of absolute and relative frequency, mean and standard deviation). The Fisher test was used to analyze the association of the variables, and Bonferroni was used for multiple comparison. A simple linear regression test was performed for the significant variables in the association tests. The results were considered statistically significant at $p < 0.05$.

The study was approved by the Research Ethics Committee of the Health Sciences Sector, based upon the protocol CEP/SD: 913.038.10.04 CAAE: 0023.0.091.000-10. According to Resolution 196/1996[18], in force at the time of the research, the ethical principles of voluntary and informed participation of each subject were respected.

RESULTS

The study enrolled 203 elderly, 123 (60.5%) were female and 80 (39.5%) were male. The age ranged between 60 and 93 years, with a mean of 70.8 ($\pm$ 7.4) years. Regarding education, 28 (13.8%) were illiterate, 120 (59.1%) had incomplete elementary school, 18 (8.8%) completed elementary school, 34 (16.8%) complete high school, and only three of the elderly (1.5%) had higher education.

For statistical analysis, the results on the education variable were grouped into the following groups: illiterate (n = 28; 13.8%), low and medium education (n = 172; 84.7%) and higher education (n = 03; 1.5%).

The mean gait speed of the elderly was 0.9 m/s (min = 0.11 m/s, max = 1.72 m/s), and the mean among women and men, respectively, was 0.85 m/s (min = 0.11 m/s, max = 1.72 m/s) and 0.98 m/s (min = 0.44 m/s, max = 1.72 m/s).

The maximum score of participants in the MMSE was 30 points, with a minimum of 13 points, and a mean of 24.64 ($\pm$3.62) points. The elderly women obtained a mean of 24.37 ($\pm$3.62) points, and the elderly man achieved the mean score of 25.06 ($\pm$3.63).

Both the cognitive scores and the gait speed values were higher for the elderly with higher education and lower among illiterate (Table 1).

The cognitive score there was a statistical significance ($p < 0.001$), with a difference between the illiterate elderly and those with low or medium education, and among

Table 1 - Mean values of cognitive and speed score of elderly gait (n = 203), according to educational levels, Curitiba, Brazil, 2014

Level of education	Mean MMSE * (±SD†)	Mean GS‡ (±SD)
Iliterate	19.33 (±3.7)	0.76 (±0.3)
Low / medium education	25.43 (±2.8)	0.92 (±0.2)
Higher education	27.33 (±2.9)	1.12 (±0.3)

*Note: * MMSE = Mini Mental State Examination test; †SD = Standard Deviation; ‡ GS = Gait speed.*

Table 2 - Association between the level of education and cognition and speed of elderly gait (n = 203), Curitiba, Brazil, 2014

Variables	P* value	Bonferroni (P value)
Mini Mental State Examination	(< 0.001)	"Iliterate" & "Low/Medium" (< 0.001) "Iliterate" & "Higher" (< 0.001) "Low/Medium" & "Higher" (0.814)
Gait speed	(0.0047)	"Iliterate" & "Low/Medium" (0.01) "Iliterate" & "Higher" (0.067) "Low/Medium" & "Higher" (0.530)

*Note: * Fisher Test*

illiterate and elderly individuals with higher education. There was no statistical difference between elderly individuals with low or medium education and the elderly with higher education (Table 2).

As for gait speed, there were also significant differences between the illiterate elderly individuals and those with low or medium education. The illiterate individuals and those with higher education are on the borderline of statistical significance. In turn, among those with low or average education and higher education has not been verified significance (Table 2).

The simple linear regression showed a statistically significant (Prob > F = 0.0072), weak correlation (R2 = 0.0354) between the gait speed and the cognitive score (MMSE) and a positive linear trend. Thereby, the better the cognitive score the higher the gait speed (p < 0.0072) (Figure 1).

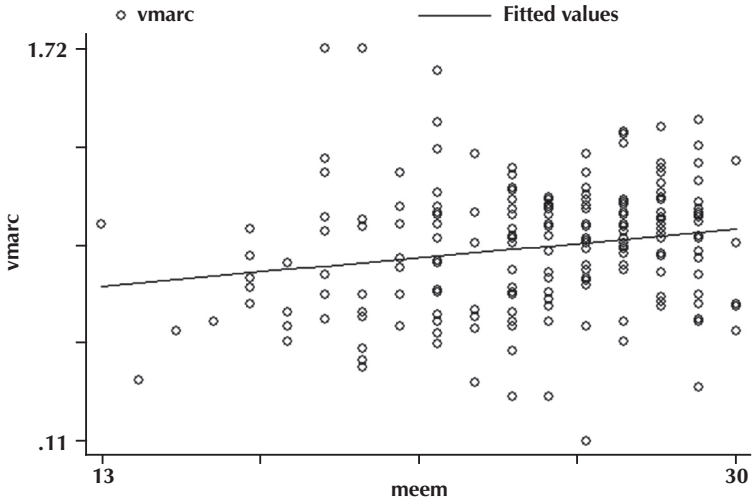

Figure 1 - Trend between gait speed and cognitive score of 203 elderly, Curitiba, Brazil, 2014

*Notes: * VMARC = gait speed; † MEEM = Mini Mental State Examination test*

DISCUSSION

In the present study, there was a predominance of women and low- and medium-education elderly individuals. In another population-based study, researchers associated sociodemographic and health characteristics and gait speed of 385 elderly individuals living in an urban area of the State of São Paulo, Brazil. The results showed a predominance of women (64.4%), high illiteracy rate (30%), and low education (82%)[5].

A multicenter cohort study followed 12,470 elderly during 16 years in order to investigate the links between cognitive components (such as the educational level), cognitive state transitions over time, and death. An important role for education was found in building the cognitive lifestyle, which can delay the onset of cognitive decline through compensatory mechanisms[19].

These data reflect the condition of many elderly Brazilians, especially females of an older age. They are women who have not had access to education due to various reasons, motivational deficits (women were supposed to be only in charge of domestic tasks), and the need for workers in the field, since most elderly participants of the study were from the rural area.

As expected, the illiterate elderly have lower cognitive scores. However, there was no statistically significant difference among the elderly with low or medium education and the elderly with higher education. These results are similar to the national and international literature with regard to education as a consistent factor associated with performance on the MMSE[16,20].

The association that is evident in the literature between the educational level and the MMSE performance through the cognitive score has been shown in national and international studies for some time. The establishment of the direct relationship between these characteristics has led, for example, to determining the cut-off points in the specific MMSE nationally for each level of education[16,21].

In this study, the comparison tests between cognitive performance and gait speed of the elderly individuals showed that older people with lower mean cognitive scores are those with lower gait speed, thereby indicating poorer physical performance. Studies have shown that gait performance is not only an automated sequence of body motions; cognitive functions play an important role in controlling the speed[11-14].

Several cognitive functions can interfere with the body translocation process during gait, such as memory, spatial perception, executive function, among others. Given this close relationship, gait speed is considered a good indicator of cognitive performance in healthy elderly with mild cognitive impairment or other morbidities[22-23].

Regarding the physical frailty syndrome, gait speed is considered one of the markers used to assess the elderly. A study considering gait speed that was performed with elderly individuals in one of the southern capitals of Brazil, whose aims were to investigate pre-frailty and the factors associated with this condition, identified a significant relationship between the slowness of the gait and low cognitive scores in this population ($p = 0.015$)[24]. A similar finding has also been found in an international cross-sectional study performed with frail and pre-frail elderly in The Irish Longitudinal Study on Aging[25].

The data emerging from the present study were different from those of a clinical trial performed in the United States with 1793 elderly women, with the aims of examining the association between the value of the modified MMSE and three physical performance measures, including gait speed in the beginning and after six years. The results showed a correlation between cognition and gait speed ($r = 0.06$; $p = 0.02$). For each 4.2 points higher on the cognitive score, a reduction of 0.04 m/s in the gait speed over six years is expected ($p \leq 0.01$)[26].

Also in the previous study, the same authors concluded that change in cognitive function was associated with changes in physical performance, but the initial physical performance was not associated with cognitive changes. In this sense, the analyses support the hypothesis that mean cognitive decline precedes or is concurrent with a decline in physical performance[26]. This outcome can be explained by the characteristics of the studied sample, which was predominantly white, with high levels of education, and a high family income.

Another longitudinal study that evaluated the relationship between the change in gait speed and cognition in a two-year follow-up with elderly individuals strengthened the association between these factors[27]. It was found that changes in gait speed were predictive of cognitive decline, even within a short period. Considering the influence of cognition on other factors, especially functional performance through the performance of daily life activities[28], one can understand the importance of the assessment of these clinical factors in order to investigate the general health of the elderly. Yet, the evaluation of gait speed can be considered easy to apply, does not require more resources for its implementation, and can be widely performed in health care institutions[24].

According to some authors[29], memory does not age in healthy elderly, and for it to be preserved, one option is to provide activities for the elderly that exercise the memory. Among them, there are cognitive stimulation workshops adapted for illiterate individuals, which provide improved cognition, functionality, socialization and integration, also in activities of daily living.

In the above study which performed cognitive stimulation workshops with 63 illiterate elderly individuals with mild cognitive impairment, the authors confirmed the importance of stimulation and pointed out the need for studies that measure the time during which the benefits remain. Thus, they suggest encouraging the development of alternative health activities for the elderly, creating community groups for the elderly, and professional training for the care to the elderly, with a multidisciplinary focus, as contributions for nursing[29].

Given these considerations, the importance of care to the elderly regarding instructing for physical exercise, to avoid a progressive loss of muscle mass and help maintain a proper gait speed, is emphasized[30]. Likewise, cognitive stimulation is essential for the illiterate elderly who tend to have a reduced gait speed and worse cognitive performance.

CONCLUSION

There was a significant association between cognitive score and gait speed in the following proportion: the higher

the cognitive score, the higher the gait speed. Education seems to be a factor of influence on cognitive score, especially illiteracy.

Such influence may be related to cognitive discouragement, since the proportion of elderly people who never attended school are expressive, or who have not had the opportunity to learn skills that are usually requested on cognitive tests, such as calculation and memory. The lack of experience in undergoing testing may be considered a factor that brings negative outcomes in the performance of the elderly.

The limitations of this research are related to the cross-sectional design, that does not allow the establishment of reverse causality, and the analysis of the factors that precede or succeed the outcome. Longitudinal and cohort studies can be used to more accurately monitor the effects of associations between variables involving cognition and physical performance, in this case, the gait speed.

As contributions of this research, it is expected that the results can guide geriatric nursing care as to the detection of changes in cognitive or physical performance of the elderly, combating adverse health events, such as the physical frailty syndrome. Moreover, it has the potential to support discussions on the planning of interventions that provide positive results in the quality of life of this age group.

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