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ORIGINAL ARTICLE

Influence of fear of falls and self-perceived balance on functional mobility of community-dwelling older adults

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Abstract

Introduction: Falls and fear of falling (FOF) have considerable consequences for older adults' health, causing physical and psychological limitations that affect daily activities. Self-perception of balance, although little investigated, may interfere with older adults' motivation and confidence in moving around, impacting their functional independence. *Objective:* To investigate the association between FOF and self-perceived balance, as well as the influence of these variables on functional mobility. *Methods:* A total of 152 independent community-dwelling older adults aged 60 to 84 years participated. Participants were assessed for self-perception of balance and FOF, and performed clinical tests: single-leg stance (SLS), Timed Up and Go (TUG), Five Times Sit to Stand (5TSS), and gait speed (GS). Binary logistic regression analyzed the association between FOF and balance self-perception. Multiple linear regression was used to evaluate the association of FOF and balance perception with clinical test performance. *Results:* FOF was positively associated with TUG ($p = 0.013$) and negatively with GS ($p = 0.004$). Balance self-perception was positively associated with SLS ($p = 0.001$) and GS ($p = 0.038$), and negatively with TUG ($p = 0.004$). *Conclusion:* Both FOF and negative balance

self-perception negatively affect functional mobility. However, balance self-perception showed a broader influence on functional test performance, while FOF was only associated with tasks involving changes in the base of support.
Keywords: Physical Functional Performance; Walking Speed; Functional Status; Self Concept; Mental Health.

Resumo

Influência do medo de cair e da autopercepção de equilíbrio na mobilidade funcional de idosos

Introdução: Quedas e o medo de cair (Fear of falling - FOF) têm consequências consideráveis para a saúde dos idosos, gerando limitações físicas e psicológicas que afetam realização de atividades diárias. A autopercepção de equilíbrio, embora pouco investigada, pode interferir na motivação e na confiança dos idosos em se locomover, afetando sua independência funcional. *Objetivo:* Investigou-se a associação entre o FOF e a autopercepção de equilíbrio, bem como a influência dessas variáveis na mobilidade funcional. *Métodos:* Participaram 152 idosos independentes, com idades entre 60 e 84 anos, da comunidade. Os participantes foram questionados sobre autopercepção de equilíbrio, FOF, e realizaram testes clínicos: equilíbrio unipodal (SLS), teste de subida e caminhada (TUG), teste de levantar e sentar cinco vezes (5TSS) e velocidade da marcha (GS). A regressão logística binária analisou a associação entre FOF e autopercepção de equilíbrio. Para avaliar a associação entre FOF e autopercepção de equilíbrio com os testes clínicos, foi realizada regressão linear múltipla ajustada. *Resultados:* O FOF, associou-se positivamente ao TUG (p = 0,013) e negativamente com o GS (p = 0,004). Enquanto a autopercepção de equilíbrio, associou-se positivamente com o SLS (p = 0,001) e o GS (p = 0,038) e negativamente ao TUG (p = 0,004). *Conclusão:* O FOF e a autopercepção negativa de equilíbrio interferem negativamente na mobilidade funcional. No entanto, a autopercepção de equilíbrio tem uma influência negativa na maioria dos testes funcionais realizados, enquanto a presença de FOF foi associada apenas com testes que envolvem mudanças na base de apoio.
Palavras-chave: Desempenho Físico Funcional; Velocidade de Marcha; Status Funcional; Autoimagem; Saúde Mental.

Resumen

Influencia del miedo a caer y de la autopercepción del equilibrio en la movilidad funcional de los adultos mayores

Introducción: Las caídas y el miedo a caer (Fear of Falling – FOF) tienen consecuencias considerables para la salud de las personas mayores, generando limitaciones físicas y psicológicas que afectan la realización de actividades diarias. La autopercepción del equilibrio, aunque poco investigada, puede interferir en la motivación y la confianza de los mayores para moverse, afectando su independencia funcional. *Objetivo:* Investigar la asociación entre el FOF y la autopercepción del equilibrio, así como

la influencia de estas variables en la movilidad funcional. *Métodos:* Participaron 152 adultos mayores independientes de la comunidad, con edades entre 60 y 84 años. Se evaluó la autopercepción del equilibrio y el FOF, y se realizaron pruebas clínicas: equilibrio unipodal (SLS), prueba de levantarse y caminar (TUG), prueba de levantarse y sentarse cinco veces (5TSS) y velocidad de la marcha (GS). Se utilizó regresión logística binaria para analizar la asociación entre FOF y autopercepción del equilibrio. Para evaluar la relación con el desempeño en las pruebas clínicas, se aplicó regresión lineal múltiple ajustada. *Resultados:* El FOF se asoció positivamente con el TUG (p = 0,013) y negativamente con la GS (p = 0,004). La autopercepción del equilibrio se asoció positivamente con el SLS (p = 0,001) y la GS (p = 0,038), y negativamente con el TUG (p = 0,004). *Conclusión:* Tanto el FOF como una percepción negativa del equilibrio afectan negativamente la movilidad funcional. Sin embargo, la autopercepción del equilibrio mostró una influencia más amplia en las pruebas funcionales, mientras que el FOF se asoció solo con tareas que implican cambios en la base de apoyo.
Palabras-clave: Rendimiento Físico Funcional; Velocidad de Marcha; Estado Funcional; Autoimagen; Salud Mental.

Introduction

With aging, several physiological changes occur. However, considering the heterogeneous aging process, the patterns of morphological, functional, psychological and social changes differ in this population, which reflects the level of independence and autonomy of each older adult [1]. The decline in the postural control system, frequently observed in the older adults, increases the risk of falling [2]. Fall, considered as a public health problem, is an event that occurs in 30% of the adults in the community over 65 years of age [3], and it is associated with several negative outcomes for the health status, such as hip fractures [4], loss of independence, reduced quality of life, decreased social interaction and premature death [5]. Many older adults show psychological traumas directly related to the experience of falls [6], such as fear of falls (FOF), which is defined as a lasting concern with the fall that leads the individual to avoid activities that he/she is still capable of performing [7]. Other factors that seem to contribute to FOF are the decrease in muscle mass, strength and power and impaired physical performance [8].

Older adults with FOF seem to have reduced independence and physical fitness, more likely to fall due to worse postural control and increased body sway [8,9], motor impairments (due to muscle changes, increased body imbalance and changes in gait), decreased confidence in their activities of daily living (ADLs), limited social interactions, worsening mental health and depression [3] and worsening quality of life [10]. With the restriction of motor activities resulting from FOF, a vicious cycle begins in which one component feeds the other and the worsening of motor and psychological aspects also negatively influences one´s self-image, also called self-perception.

Self-perceived balance is one of the components of physical self-perception, although it is often used as a synonym for fear of falling through the application of The Falls Efficacy Scale International (FES-I) [11] and the Activities-Specific Balance Confidence Scale (ABC) [12], which require some

time availability by the professional to administrate those questionnaires [13]. Although there are questionnaires developed to screen for FOF, many studies have used single-item questions about FOF [14,15], and self-rated health [14]. The use of direct questions regarding FOF has been shown to have a good correlation with validated scales including the Falls Efficacy Scale (r = 0.43) [16], making it much more simple, easy-to-understand, attractive, objective, and fast, and therefore, more suitable for the clinical practice due to the professional's time demand.

On the other hand, questioning the older adults about their self-perceived balance is not usual [17]. In this sense, direct questions about the presence or not of FOF and self-perceived balance can be beneficial as they are simple and easy-to-understand questions. Identifying the self-perception of the older adults about their abilities and whether self-perception interferes with their functional capacity are relevant clinical aspects when approaching the individual's health with a holistic view, understanding the importance of multi-professional assistance in caring for the older adults.

Therefore, the objective of the study was to verify the association between fear of falls and self-perceived balance with the functional mobility of the community-dwelling older adults. The study hypothesizes that older adults who are more afraid of falls and who have a negative self-perception of balance have worse performance in functional clinical tests and, therefore, a multi-professional approach is necessary for the individual's health care.

Methods

Study design and sample

A cross-sectional study with 152 independent older adults, residents of the city of in the state of aged between 60 and 84 years, of both sexes, who agreed to sign the Informed Consent Form. The study was approved by the Ethics Committee for Research on Human Beings and the participants were recruited through direct contact with the community and events provided for the older adults by the (convenience sample).

The ineligibility criteria were older adults with self-reported musculoskeletal conditions that interfered with the performance of functional tests (daily pain, presence of prostheses, fractures in the six months prior to the evaluation or symptomatic dysfunction of the spine and lower limbs); neurological disease; complaints of dizziness; decompensated cardiovascular disease; low score on the 10-point Cognitive Screener (10-CS) according to educational level (<8 points) [17] and a deficit of protective sensitivity in the feet by an inability to detect the application at least of 10 g of the Semmes-Weistein monofilaments (SORRI, Bauru/SP, Brazil) on the sole of the foot [18]. Still, the participant could be excluded from the study if they did not complete the tests proposed for refusing or for having blood pressure greater than or equal to 160/90 mmHg.

Procedures

All procedures were performed by three properly trained researchers. For the characterization of the sample, data were collected: sex, age, weight, height, body mass index (BMI), history of falls in the 6 months prior to the assessment and level of physical activity through the International Physical Activity Questionnaire (IPAQ) [19] Fall was defined as an unintended contact on a supporting surface [20].

Still, the participants were asked about the presence of fear of falls and the self-perception of their balance. The question about fear of falling consisted of the question "Are you afraid of falling?", followed by a detailed explanation of what was considered fear. To this question, participants could answer "1 = No, I am not afraid of falling" or "2 = Yes, I am afraid of falling". Fear is considered when there is an obvious external trigger that causes an unpleasant feeling of tension, nervousness, anxiety, stress and physical disturbance [21]. The participants were warned not to confuse fear of falling with being cautious. Being caution is considered as an "excess of care that can alter the level of concentration in other activities, in order to anticipate and avoid a known situation that can lead to loss of balance and fall". For the self-perception of balance, the explanation of the meaning of balance was provided and then the participants were asked "How do you consider your balance?", with the answer options "1 = Very good", "2 = Good", "3 = Regular", "4 = Poor and "5 = Very poor" [15].

Afterwards, the functional tests were performed (single leg stance - SLS; timed up and go - TUG; five times stand to sit = 5TSS; gait speed - GS). The clinical tests were chosen due to the fact that they are tests widely used in the geriatric and gerontology clinical practice, they are able to evaluate the functional mobility and balance performance of older adults and previous studies have shown the excellent test-retest reliability of the tests. All functional tests were repeated more than once, because the first attempt was performed to familiarize the participants with the requested test. The tests were carried out in a random order by two researchers who had no access to the interview responses.

For the SLS, the participants were instructed to remain for 30 seconds on the dominant lower limb (defined as the limb of choice for kicking a ball), keeping their arms relaxed along the body, and the contralateral lower limb kept with the knee flexed at 90º and with the hip in a neutral position. During the test, participants should remain with their eyes fixed on a target 5 cm in diameter, placed at eye level and 1.5 m away from the individual [14]. The length of stay was timed and interrupted if the participant touched the floor with the non-dominant lower limb, performed a hip strategy or moved the upper limbs to regain balance. The test was repeated 3 times and the mean value was considered. The single-leg stance test has excellent test-retest reliability (ICC = 0.86; 95% CI = 0.70 - 0.93) [22].

In 5TSS, participants should get up and sit on a chair, as quickly as possible, 5 times in a row, with the upper limbs crossed in front of the chest [23]. The task execution was timed, the test was repeated 2 times, and the mean value was considered. The 5TSS has excellent test-retest reliability (ICC = 0.81) [24].

For the TUG, from the sitting position with the back resting on the back of the chair and feet on the floor, at the command of the evaluator, participants should get up, walk 3 meters at their usual speed, rotate 180º, walk back until the chair and sit back against the back again [25] The task execution was timed, the test was repeated 3 times and the

mean value was considered. The TUG has excellent test-retest reliability (ICC = 0.97 - 0.98) [26].

For GS, participants were asked to walk a distance of 8 meters at their usual speed. The speed was timed in the central 5 m, disregarding the initial 1.5 m (acceleration) and the final 1.5 m (deceleration). The test was performed 3 times and the mean value was considered. GS test has excellent test-retest reliability (ICC between 0.96 to 0.98) [27].

Statistical analysis

Statistical analyses were performed using the SPSS program (Version 17.0 - SPSS Inc,) and considered significant if p £ 0.05. In order to characterize the sample, means, standard deviations and frequencies were used. To verify the association between fear of falls (dependent variable) and self-perceived balance (independent variable), binary logistic regression was performed, adjusted for age, sex, number of falls and level of physical activity. For all analyzes, the category of fear of falling considered as the reference category was the absence of fear of falling. For the self-perception of balance, the categories “very good” and “good” were joined to form the category “positive perception” and the categories “regular” and “bad” were joined to form the category “negative perception” of balance, which in turn was used as reference category.

To verify the association between fear of falling and self-perceived balance (independent variables) and performance in the functional mobility tests of SLS, TUG, 5TSS and GS (dependent variables), adjusted multiple linear regression by age, sex, number of falls, weight, height and level of physical activity (IPAQ) was performed. The association was determined by the regression coefficient for non-standard continuous measures (b) and the overall performance of the final models was assessed by Nagelkerke’s R^2. The sample power of 96% was calculated considering the sample size used (n = 152), alpha value of 0.05 and the lowest R^2 found in the present study (R^2 = 0.08; effect size = 0.29). The sample power was calculated using the G * Power software, version 3.1.92 (Universitat Kiel, Kiel, Germany).

Results

Initially, 183 older adults were contacted, of whom 28 refused to participate and 3 were not eligible for the study (daily pain in the knee and / or lumbar spine). Thus, 152 older adults were included in the analyses. The sample was predominantly composed of females (81%), with moderate level of physical activity (63.2%) and 30% had a history of falls in the 6 months prior to the survey. About half of the sample reported fear of falls (49.3%) and most of the sample considered their balance to be good (51.3%), followed by regular (30.9%) (Table 1).

Table 1 - *Sample characterization. Values expressed as mean (standard deviation) and frequency*

	Total sample (n = 152)
Age (years)	68.75 (5.27)
Male n (%)	29 (19)
Weight (kg)	68.91 (12.97)
Height (m)	1.56 (0.07)
BMI (kg.m^{-2})	27.96 (4.31)
History of falls n (%)	46 (30.3)
Level of physical activity n (%)	
Low	47 (30.9)
Moderate	96 (63.2)
High	9 (5.9)
Fear of falling n (%)	75 (49.3)
Self-perception of balance n (%)	
Very good	24 (15.8)
Good	78 (51.3)
Regular	47 (30.9)
Poor	3 (2)
Very Poor	0
Single-leg stance (s)	18.49 (10.55)
Timed up and go (s)	9.08 (2.02)
Five times sit-to-stand (s)	13.38 (3.10)
Gait speed (m/s)	1.18 (0.26)

BMI: body mass index.

Binary logistic regression demonstrated an association between fear of falling and self-perceived balance (b = -0.78; odds ratio - OR = 0.45; 95% confidence interval - 95% CI = 0.22 - 0.94; p = 0.035). Table 2 shows that the presence of FOF impairs the performance of TUG (p = 0.013) and GS (p = 0.004), which means that the fact the older adult is afraid of falling increases the time of execution of the TUG and reduces walking speed.

Table 2 - *Association between self-reported fear of falls and functional tests*

	Multiple linear regression		
Dependent variables	b	P value	R^2
Single-leg stance (s)	-2.13	0.154	0.34
Timed up and go (s)	0.76	**0.013***	0.25
Five times sit-to-stand (s)	0.79	0.126	0.07
Gait speed (m/s)	-0.11	**0.004***	0.28

*p < 0.05 according to multiple linear regression (adjusted for age, sex, number of falls, weight, height and level of physical activity).

Table 3 shows that the better the older adult considers his / her balance, the better the performance in functional mobility tests is, i.e., the greater the positive of balance self-perception, the longer the permanence on SLS (p = 0.001), the shorter the execution time of the TUG (p = 0.004), and faster GS (p = 0.038).

Table 3 - *Association between self-perceived balance and functional tests*

	Multiple linear regression		
Dependent variable	b	P value	R^2
Single-leg stance (s)	5.28	0.001*	0.38
Timed up and Go (s)	-0.95	0.004*	0.26
Five times sit-to-stand (s)	-1.02	0.066	0.08
Gait speed (m/s)	0.08	0.038*	0.26

*p < 0.05 according to multiple linear regression (adjusted for age, sex, number of falls, weight, height and level of physical activity).

Discussion

The results of our study showed that psychological aspects, such as FOF and self-perception of balance, influence functional mobility, and each psychological aspect influences the clinical tests differently. The results of our study showed that FOF (presented in 49.3% of the sample) has a negative influence on TUG and GS (tests that involve walking). In addition, the results showed that the better the self-perception of balance in the older adult, the better the performance in functional tests (single SLS, TUG, and GS); likewise, the worse the self-perception of balance, the greater the chance of being afraid of falls.

The explanation for the relationship between self-perception and functional capacity seems to be based on the concomitant involvement between physical and psychological domains, with physical and psychological impairments affecting each other. Older adults who are afraid of falls are more likely to have negative thoughts about themselves, such as overly pessimistic views about the consequences

of falls and low confidence related to falls [28]. Also, the negative self-perception in the older adults causes negative thoughts related to the ability to stay balanced, having as a result, greater concern and fear when performing motor activities that require changes in the support base (such as: walking, climbing stairs, turning) [29].

Based on the fact that there are cognitive-motor interactions and based on our results that reinforce the brain function integrations, it is relevant to incorporate in our clinical practice routine the questions about the patient's self-perception. Studies have shown the importance of using self-report instrument, since self-report allows the participant to respond about their self-image, giving them the possibility to consciously interpret their current state [30].

In turn, FOF has been associated with TUG test, functional reach test, tandem gait test [31], dual-task ability [32], GS [33], decline in ADLs, restricted social and physical activity [3,34]. Fear and insecurity lead to a reduction in the practice of routine activities with a consequent worsening in the quality of movement and a higher risk of falls, thus generating a vicious cycle [35], which demonstrates that FOF impairs physical-functional components. In an attempt to understand whether the FOF in older adults is related to specific physical aspects when comparing the strength of the hip abductors and adductors, Bocarde et al [14] have found no difference in the hip muscles in the comparison between groups with and without FOF.

Our results corroborate findings in the literature that have shown that older adults who are afraid of falling have reduced gait speed [9,36], which can increase the risk of falling, because 55% of falls occur during dynamic tasks, such as walking in older adults [37]. Moreover, it was observed that older people who claim to fear of falls had lower GS test when compared to the group without FOF, regardless of whether they were performing single-task or dual-task gait [9].

Using the FES-I-BRAZIL questionnaire, Lopes et al.[1] observed a correlation between TUG and FOF. These findings corroborate our results, which showed that FOF, after adjusting for confounding variables such as age, sex, number of falls, weight, height, and level of physical activity, was associated with poorer functional mobility as assessed by TUG and GS.

The results of our study showed no association between FOF and SLS, neither between both FOF and self-perceived balance with 5TSS, which may be associated to the fact that these tasks are motor activities that do not involve support base changes and may not generate a great sense of insecurity for the older adults.

Although there are studies that analyze the balance using validated evaluation scales, such as FES-I, BERG, and ABC, the aim of our study was to obtain the self-perception of older adults using a single and direct question. Questionnaires already molded for certain activities limit the old adult to carry out a broader and more conscious assessment of his current functional state, allowing the interpretation of his self-perception according to the activities carried out in his daily life, since balance is necessary for the proper accomplishment of countless daily tasks and the routine of each old adult is individual.

Our results showed that negative perception of balance and FOF are associated in different ways with functional mobility tests widely used in the clinical practice of the geriatrician and gerontologist, with a negative perception of balance being related to a greater number of functional domains.

The limitation of the study was the lack of anxiety assessment, since studies suggest that older adults who are afraid of falling have increased anxiety which can lead to a loss of attention related to a threat (the fall itself) and a less effective working memory, which is needed to perform complex locomotor tasks [38,39]. Also, muscle function evaluations would be helpful to understand the mechanisms by which such self-report issues impair the participants' functional capacity

Conclusion

The results of this study suggest that the older adult's negative self-perception of balance is associated with a worse performance in functional tests and that the greater presence of FOF results in lower performance in physical tests that require the support base alternating as the TUG and GS. In clinical practice, direct questioning of self-perceived balance (usually less addressed than FOF) can be useful for older adults´ assessment because it is more comprehensive than questioning about FOF and can serve as an initial motor-psychological screening, helping to identify those older adults who need multi-professional follow-up.

Conflict of Interest

The authors declare that there are no conflicts of interest of any kind.

Conflict of Interest

Own funding.

Authors' contribution

Research conception and design: ACLB, JMP, RCFJ, DCCA. Data collection: ACLB, JMP, RCFJ. Data analysis and interpretation: JMP, RCFJ, DCCA. Manuscript writing: ACLB, DCCA. Critical review of the manuscript for important intellectual content: JMP, RCFJ, DCCA.

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