

**TITLE: Associations between the impact of menopausal symptoms and fall-related self-efficacy.**

João Espírito Santo, MHS<sup>a,b</sup>

Nuno Eduardo Marques de Loureiro, PhD<sup>b</sup>

Vânia Brandão Loureiro, PhD<sup>b</sup>

Agustín Aibar-Almazán, PhD<sup>c</sup>

Fidel Hita-Contreras, MD, PhD<sup>c</sup>

<sup>a</sup>Escola Superior de Saúde Atlântica, 2730-036 Barcarena, Portugal.

<sup>b</sup>Escola Superior de Educação, Instituto Politécnico de Beja, Beja, Portugal.

<sup>c</sup>Department of Health Sciences, Faculty of Health Sciences, University of Jaén. Jaén, Spain.

**Funding received for this work:** This study was performed under the project UP Again Senior (PNDPT - IPDJ - CP/532/DDT/2020).

**Conflict of interest:** The authors claim to have no conflict of interest.

**Data statement:** The data that has been used is confidential. Due to the sensitive nature of the questions asked in this study, survey respondents were assured raw data would remain confidential and would not be shared.

**Address correspondence to:**

Agustín Aibar-Almazán.

Department of Health Sciences, Faculty of Health Sciences, University of Jaén, E-23071, Jaén, Spain. Tel +34-953-213554, Fax +34-953-012141,

E-mail: aaibar@ujaen.es

# ASSOCIATIONS BETWEEN THE IMPACT OF MENOPAUSAL SYMPTOMS AND FALL-RELATED SELF-EFFICACY.

## ABSTRACT

**Objective:** To analyze the association between the severity of menopausal symptoms and two important fall risk factors, namely balance confidence and fear of falling, among Portuguese and Spanish postmenopausal women aged  $\geq 65$  years.

**Methods:** A cross-sectional, observational study was conducted on 363 women ( $66.21 \pm 9.00$  years) from several Portuguese and Spanish locations. The Menopause Rating Scale (MRS) was used to evaluate the severity of menopausal symptoms, while the Falls Efficacy Scale-International and Activities-specific Balance Confidence Scale-16 items were used to assess balance confidence and fear of falling, respectively. Anxiety and depression (evaluated by the Hospital Anxiety and Depression Scale), age, time since the onset of menopause, body mass index (BMI), history of falls, osteoporosis, smoking habit, physical activity level, and nocturia were considered as potential confounders. Independent associations were analyzed after adjusting for potential confounding variables. Student's t test, bivariate correlations and multivariate linear regression analysis were performed.

**Results:** A total of 363 women ( $66.21 \pm 9.00$  years) participated in the study, 192 from Portugal and 171 from Spain. Linear regression analysis indicates that more severe menopausal symptoms at a somato-vegetative level (beta coefficient ( $\beta$ ) = -0.25; 95% confidence interval (95% CI): -2.09 to -0.81;  $p = <0.001$ ), a higher BMI ( $\beta$  = -0.16; 95% CI: -1.22 to -0.22;  $p = 0.005$ ), and osteoporosis ( $\beta$  = 0.14; 95% CI: 1.36 to 10.08;  $p = 0.010$ ) were associated with lower balance confidence values. On the other hand, a higher score in the MRS somato-vegetative domain ( $\beta$  = 0.22; 95% CI: 0.27 to 0.79;  $p = <0.001$ ), depression ( $\beta$  = 0.36; 95% CI: 0.59 to 1.08;  $p = <0.001$ ), and years after the menopause onset ( $\beta$  = 0.15; 95% CI: 0.04 to 0.22;  $p = 0.006$ ) were linked to increased fear of falling. **Conclusions:** The findings of our study show that, after taking into account possible confounders, increased severity of menopausal symptoms at a somatic level was associated with heightened fear of falling and diminished balance confidence.

**Key Words:** Menopausal symptoms; Fear of falling; Self-efficacy; Balance confidence; Postmenopausal women.

## INTRODUCTION

Menopause is characterized by physiological, psychosocial, and sociological changes associated with a reduction in ovarian function<sup>1</sup>. Some of the most common postmenopausal symptoms include vasomotor alterations such as night sweats and hot flashes, as well as mood and sleep problems, fatigue, and urogenital atrophy. These symptoms may persist for years, and it has been shown that a significant proportion of women aged 60 years and over continue to report persistent vasomotor symptoms<sup>2,3</sup>. Among the symptoms that may appear at the menopause stage, an association has been reported with balance deterioration<sup>1</sup>.

One-third of women over 60 suffer at least one fall per year<sup>4</sup>, with falls being a major health problem among postmenopausal women<sup>5</sup>. It has been described that estrogen-related body composition modifications that occur in menopause, such as increases in body weight and central adiposity, are associated with a higher risk of falling and

disability<sup>6-8</sup>. On the other hand, postmenopausal osteoporosis is associated with increased fall-related morbidity (i.e. hip fractures) and loss of independence<sup>9</sup>.

This can lead to psychological difficulties directly related to falls<sup>10,11</sup>, including fear of falling, loss of self-efficacy, loss of self-confidence, low balance confidence, and avoidance of activities<sup>10-13</sup>. Self-efficacy is "the perception of an individual's capabilities in a given domain of activities"<sup>14</sup>. For some time, it was believed that fear of falling was simply the result of the psychological trauma associated with a fall, and was thus also named "post-fall syndrome"<sup>10</sup>. This syndrome was first reported in 1982 by Murphy and Isaacs who noted that, after a fall, people developed an intense fear of walking and experienced changes in their gait<sup>15</sup>. Fear of falling has been identified as one of the main symptoms of this syndrome. Since then, fear of falling has gained recognition as a specific health problem among the older population<sup>16</sup>. People affected by fear of falling lunge towards furniture (or a person) and, once safe, bring their feet close to their body and seek the next piece of furniture for support<sup>16</sup>. However, fear of falling is also commonly found in older adults who have yet to experience a fall<sup>17</sup>.

Another important fall risk factor is the decrease in balance confidence, which refers to an individual's confidence in his or her ability to maintain balance and remain steady<sup>18</sup>. Low balance confidence can lead to limitations in daily-life activities and restrictions in physical activity, which can cause falls, increased fear of falling, and loss of independence, thus causing a vicious circle that makes individuals increasingly isolated and dependent<sup>12</sup>.

This study aims to analyze the associations between the severity of menopausal symptoms and fall-related self-efficacy among middle-aged and older community-dwelling postmenopausal women. We hypothesized that, after accounting for possible confounders, greater severity of menopausal symptoms might be associated with increased fear of falling and decreased balance confidence, and therefore to an increased risk of falling.

## **METHODS**

### **Study design and participants**

An analytical cross-sectional study was conducted from September 2020 to February 2022. Recruitment was carried out via e-mail and telephone by contacting several senior centers from Jaén (Spain), and Lisbon, Serpa, and Beja (Portugal). This research was approved by the Research Ethics Committee of the University of Jaén, Spain (SEPT.20/3.TES). All women signed written informed consent forms before the beginning of the study, which was conducted in accordance with the Declaration of Helsinki, good clinical practices, and applicable laws and regulations. Inclusion criteria were: community-dwelling ambulatory women aged  $\geq 65$  years, able to understand the instructions and questionnaires, and willing to provide informed consent to participate in the study. Participants were excluded if undergoing hormone therapy, had conditions that limit balance and physical activity, or were diagnosed with chronic and/or severe medical disease or any neuropsychiatric disorder that could influence the results of the questionnaires and tests.

### **Study variables**

Data were collected by in-person and online questionnaires. Age, time since menopause onset, smoking habit, osteoporosis, and history of falls in the previous 12 months (yes/no)

were collected. A fall was defined as “an unexpected event in which the participant came to rest on the ground, floor, or lower level”<sup>19</sup>. Nocturia was defined as having “to wake at night one or more times to void”<sup>20</sup>. Physical activity level (yes/no) was assessed following the guidelines of the American Heart Association for adults, i.e. to perform at least 150 min of moderate physical activity or 75 min of vigorous physical activity per week<sup>21</sup>. Weight was obtained by a 100g-130 kg precision digital weight scale (Tefal, Barcelona, Spain) and height was estimated by an adult height scale (T201-T4 Asimed, Barcelona, Spain). Body mass index (BMI) was assessed by dividing the participant’s weight (kg) by her height (m<sup>2</sup>). A BMI < 25 kg/m<sup>2</sup> indicates normal weight, 25 ≤ BMI < 30 kg/m<sup>2</sup> indicates overweight, and BMI ≥ 30 kg/m<sup>2</sup> indicates obesity<sup>22</sup>. Waist and hip circumferences were measured with a 1.5-meter flexible tape.

In order to assess the severity of the menopausal symptoms and their impact on quality of life, the Menopause Rating Scale (MRS) was used<sup>23,24,25</sup>. This questionnaire consists of 11 items rated on a 5-point Likert scale (ranging 0–4) and grouped into three domains or subscales: somatic (4 items), psychological (4 items), and urogenital (3 items). A total score also results, with higher scores indicating greater impact of menopausal symptoms. Values ≥ 9 (somatic), ≥ 7 (psychological), ≥ 4 (urogenital), and ≥ 17 (total) were deemed to be severe.

The Falls Efficacy Scale-International (FES-I)<sup>26-28</sup> was used to evaluate the participants’ fear of falling. This is a 16-item questionnaire, with total scores ranging from 16 (complete absence of concern) to 64 (extreme concern). A cut-off score > 26 has been shown to be an independent predictive factor for future falls<sup>29</sup>.

The Activities-specific Balance Confidence scale (ABC) was employed to quantify the level of balance confidence when performing of activities of daily living<sup>18,30,31</sup>. This instrument consists of 16 items ranging 0-100%, and the total score is obtained by summing the ratings (0-1600) and then dividing by 16. A higher percentage indicates a greater level of balance confidence. A cut-off score < 67% has been identified as a reliable means to predict a future fall<sup>32</sup>.

The Hospital Anxiety and Depression Scale (HADS) is a widely used questionnaire for assessing the severity of anxiety and depression symptoms<sup>33-35</sup>. This tool has 14 items, of which 7 are in the anxiety and 7 in the depression subscale. Each subscale has a score ranging 0-21, where higher scores indicate more severe symptoms.

### **Sample size calculation**

The G\*Power software (version 3.1.9.7)<sup>36</sup> was used to calculate the sample size required to find associations between balance confidence and the fear of falling with the 4 independent variables (MRS total score and the three MRS subscales or domains) as well as ten possible confounders (anxiety, depression, age, time since onset of menopause, BMI, physical activity level, history of falls, osteoporosis, smoking habit, and nocturia). Assuming a type I error of 5%, a statistical power of 80%, with a potential number of 14 independent variables and an effect size (adjusted R<sup>2</sup>) of 0.15, the total sample size required is 135. Thus, the final number of participants (n = 363) was considered sufficient for the purposes of this study.

### **Data Analysis**

Categorical variables were expressed as frequencies and percentages, and continuous variables were summarized as means and standard deviations. Student’s *t*-test and a

bivariate correlation analysis were carried out to analyze the individual associations of the severity of menopausal symptoms as assessed by the MRS total score and its 3 domains, as well as anxiety, depression, age, time since menopause, BMI, history of falls, osteoporosis, smoking habit, physical activity level, and nocturia (possible confounders) with fear of falling and balance confidence (dependent variables). After that, a multivariate linear regression model was used to determine any possible independent association. Fear of falling and balance confidence were individually introduced as dependent variables in separate models. Any independent variables exhibiting significant individual associations ( $p < 0.05$ ) were included in the multivariate linear regression. Adjusted  $R^2$  was calculated to assess the model's goodness of fit. The magnitude of the associations was assessed by the beta coefficient ( $\beta$ ) and the 95% confidence interval (CI) for the individual variables. A 95% confidence level was used ( $p < 0.05$ ). Data management and analysis were performed using the IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, N.Y., USA)

## RESULTS

The descriptive characteristics of the participants of this study are displayed in Table 1. A total of 363 women ( $66.21 \pm 9.00$  years) finally took part in this study, 192 from Portugal and 171 from Spain. Their mean BMI value was  $28.32 \pm 4.38$  kg/m<sup>2</sup>, in the overweight range but close to obesity. As for the severity of the menopausal symptoms, mean MRS scores reflect a severe impact of these symptoms on the quality of life of participants, of which 42.15% declared to have experienced at least one fall in the last 12 months. The FES-I mean score revealed a high risk of falling, unlike ABC-16 scores ( $26.34 \pm 9.87$  and  $70.57 \pm 21.66$ , respectively).

The study of the individual associations (Table 2) showed significant correlations between increased impact of menopausal symptoms in the MRS total score, as well as in the somato-vegetative and psychological domains, and lower balance confidence ( $p < 0.001$ ,  $p = 0.003$ , and  $p = 0.001$ , respectively) and greater fear of falling ( $p = 0.001$ ,  $p = 0.018$ , and  $p = 0.003$ , respectively). There were no associations between the dependent variables of this study and the severity of menopausal symptoms at the psychological or urogenital level. As for possible confounders, both lower values in the ABC-16 and the FES-I scores were linked to greater age, years since menopause onset, and BMI, as well as to higher levels of depression symptoms (Table 2). Significant independent differences in ABC-16 and FES-I scores were observed regarding osteoporosis and smoking, while the history of falls was individually related only to lower balance confidence, and not being physically active and nocturia were individually associated to greater fear of falling (Table 3).

The analysis of independent associations, carried out via a multivariate linear regression (Table 4) showed that lower balance confidence levels were independently associated with more severe menopausal symptoms at a somato-vegetative level ( $\beta = -0.25$ ; 95% CI: -2.09 to -0.81;  $p < 0.001$ ), a higher BMI ( $\beta = -0.16$ ; 95% CI: -1.22 to -0.22;  $p = 0.005$ ), and osteoporosis ( $\beta = 0.14$ ; 95% CI: 1.36 to 10.08;  $p = 0.010$ ). As for the fear of falling, significant independent associations were found with higher scores in the MRS somato-vegetative domain ( $\beta = 0.22$ ; 95% CI: 0.27 to 0.79;  $p < 0.001$ ), depression ( $\beta = 0.36$ ; 95% CI: 0.59 to 1.08;  $p < 0.001$ ), and years after the onset of menopause ( $\beta = 0.15$ ; 95% CI: 0.04 to 0.22;  $p = 0.006$ ).

## DISCUSSION

This study aimed to examine the associations between the severity of the impact of menopausal symptoms and some important fall risk factors, such as fall-related self-efficacy and functional balance, among community-dwelling middle-aged and older postmenopausal women. The findings of our study indicate that, after accounting for possible confounders, increased fear of falling and diminished balance confidence were associated with increased severity of the menopausal symptoms at a somatic level.

In the present study 42.5% of the participating women reported having had at least one fall in the last 12 months. This value is higher than those found in previous studies such as Ersoy et al.<sup>29</sup> (28.8%); Hita-Contreras et al.<sup>37</sup> (18.7%); Ahn<sup>38</sup> (16.8%); or Silva et al.<sup>39</sup> (29.3%). Based on a meta-analysis that included 42429 women<sup>40</sup>, the following facts can explain this difference in values: a) participants in our study are, on average, older ( $66.21 \pm 9.00$  years) than those in the studies cited, with older age being a significant risk factor for falls among postmenopausal women<sup>40</sup>; and b) the mean value of FES-I total scores was  $26.34 \pm 9.8^{37,41}$ , with higher values being associated with increased risk of falling<sup>40</sup>. Despite the high risk of falls (established by FES-I scores, a tool able to assess individual confidence on maintaining balance during ambulation activities without falling or feeling unstable), the total score of the ABC-16 questionnaire was found to be  $70.57 \pm 21.66$ , a value that is not related to a risk of falls<sup>41</sup>. The fact that three systematic literature reviews of 10, 20, and 62 articles respectively concluded that the association of anxiety and depression with fear of falling and self-efficacy is weak-to-moderate at best<sup>42-44</sup>, and considering that the HADS questionnaire showed moderate anxiety ( $9.77 \pm 5.21$ ) and depression ( $5.45 \pm 3.51$ ) values for our participants, we may conclude that women in our study are not subject to a particularly high risk of falling.

Regarding the independent associations between potential confounding variables and the results of ABC-16 and FES-I, our findings show that decreased balance confidence was associated with higher BMI and osteoporosis levels, and that increased fear of falling was associated with time elapsed since the onset of menopause, although the magnitude of the associations were modest, with beta-coefficient values ranging from 0.14 (osteoporosis) to 0.36 (depression). These results are similar to those of a meta-analysis of 11 prospective cohort studies from 7 countries, which showed that older age, higher BMI, and a diet low in calcium (which predisposes postmenopausal women to osteoporosis) are increased risk factors for falls among postmenopausal women<sup>44</sup>. Weight gain and higher BMI in older women are closely related to decreased muscle strength, balance, and stability, which increases the risk of falls<sup>40</sup>.

Concerning the independent associations found between the severity of menopausal symptoms and the results in the ABC-16 and FES-I, all the individual associations we found were confirmed. Lower balance confidence and increased fear of falling were associated with greater severity of symptoms in the somatic-vegetative domain, but the size of the associations was limited. One explanation to these results may be found in the studies published by Ekblad et al.<sup>45</sup> and Tulmac and Simsek<sup>46</sup>, which showed that women with frequent vasomotor symptoms appear to be at greater risk of unsteadiness and vertigo than those without. In both studies the authors hypothesize that women with vasomotor symptoms have greater problems maintaining postural balance because hot flashes and sweating affect the quality of night-time sleep, which in turn may influence concentration and balance function. Thus, they assume that vasomotor symptoms may have a negative effect on the central integration of essential neurological impulses related to postural balance in the central nervous system mediated by neurotransmitters, the concentration of which may be altered in individuals who exhibit said symptoms.

Considering the results of our study, it is also possible to verify the independent association between the level of depressive symptoms and FES-I outcomes, after finding

that more severe symptoms of depression were associated with heightened fear of falling. Although the characteristics of the samples are different, similar values have been previously described<sup>47-49</sup>, linking depression to lower functional mobility in women aged 60 and over. Although the evidence, according to Peeters et al.<sup>11</sup>, does not allow to conclude whether depression may or may not cause fear of falling, the same author suggests that an explanation may be found in that people with depression restrict their activities due to low mood and/or motivation.

There are some limitations to our study that should be considered. Its cross-sectional design implies that we can only find associations, not causal relationships, although the theoretical postulates analyzed support these potential causal links. Another limitation concerns the fact that this study was conducted on postmenopausal women recruited from a specific geographical area, and therefore any generalizations of its results must be limited to people with similar characteristics to those in our sample. The magnitude of the associations was modest and the interpretation of the results should take this into consideration. Finally, sensitivity analysis were not conducted in this study (for instance, separate models for Spanish vs. Portuguese women).

## CONCLUSIONS

The findings of the present study suggest that the increased severity of menopausal symptoms at a somatic level is associated with lower fall-related self-efficacy, as assessed through measurements of balance confidence and fear of falling, as well as with higher levels of self-perceived fatigue. Our results also show that higher age and BMI, as well as a history of falls, were related to decreased balance confidence and increased fear of falling, which was also affected by lower levels of physical activity.

## REFERENCES

1. Cheng MH, Wang SJ, Yang FY, Wang PH, Fuh JL. Menopause and physical performance--a community-based cross-sectional study. *Menopause* 2009;16:892-6. doi: 10.1097/gme.0b013e3181a0e091.
2. David PS, Kling JM, Vegunta S, et al. Vasomotor symptoms in women over 60: results from the Data Registry on Experiences of Aging, Menopause, and Sexuality (DREAMS). *Menopause* 2018;25:1105-1109. doi: 10.1097/GME.0000000000001126.
3. Freeman EW. Hot flushes and the menopause: how long should they be expected to last? *Maturitas* 2014;78:153-4. doi: 10.1016/j.maturitas.2014.04.010.
4. Barrett-Connor E, Weiss TW, McHorney CA, Miller PD, Siris ES. Predictors of falls among postmenopausal women: results from the National Osteoporosis Risk Assessment (NORA). *Osteoporos Int.* 2009;20:715-22. doi: 10.1007/s00198-008-0748-2. .
5. Kanis JA, Cooper C, Rizzoli R, et al. Identification and management of patients at increased risk of osteoporotic fracture: outcomes of an ESCEO expert consensus meeting. *Osteoporos Int* 2017;28:2023-2034. doi: 10.1007/s00198-017-4009-0.
6. Alley DE, Chang VW. The changing relationship of obesity and disability, 1988-2004. *JAMA* 2007;298:2020-7. doi: 10.1001/jama.298.17.2020.

7. Cho BY, Seo DC, Lin HC, Lohrmann DK, Chomistek AK. BMI and Central Obesity With Falls Among Community-Dwelling Older Adults. *Am J Prev Med* 2018;54:e59-e66. doi: 10.1016/j.amepre.2017.12.020.
8. G R Neri S, S Oliveira J, B Dario A, M Lima R, Tiedemann A. Does Obesity Increase the Risk and Severity of Falls in People Aged 60 Years and Older? A Systematic Review and Meta-analysis of Observational Studies. *J Gerontol A Biol Sci Med Sci* 2020;75:952-960. doi: 10.1093/gerona/glz272.
9. Hita-Contreras F, Martínez-Amat A, Cruz-Díaz D, Pérez-López FR. Osteosarcopenic obesity and fall prevention strategies. *Maturitas* 2015;80:126-32. doi: 10.1016/j.maturitas.2014.11.009.
10. Legters K. Fear of falling. *Phys Ther* 2002;82:264-72. doi: 10.1093/ptj/82.3.264.
11. Peeters G, Bennett M, Donoghue OA, Kennelly S, Kenny RA. Understanding the aetiology of fear of falling from the perspective of a fear-avoidance model - A narrative review. *Clin Psychol Rev* 2020;79:101862. doi: 10.1016/j.cpr.2020.101862.
12. Aibar-Almazán A, Martínez-Amat A, Cruz-Díaz D, et al. Effects of Pilates on fall risk factors in community-dwelling elderly women: A randomized, controlled trial. *Eur J Sport Sci* 2019;19:1386-1394. doi: 10.1080/17461391.2019.1595739.
13. Hadjistavropoulos T, Delbaere K, Fitzgerald TD. Reconceptualizing the role of fear of falling and balance confidence in fall risk. *J Aging Health* 2011;23:3-23. doi: 10.1177/0898264310378039.
14. Bandura A. Reflections on self-efficacy. *Adv Behav Res Ther* 1978;1:237-269. [https://doi.org/10.1016/0146-6402\(78\)90012-7](https://doi.org/10.1016/0146-6402(78)90012-7).
15. Murphy J, Isaacs B. The post-fall syndrome. A study of 36 elderly patients. *Gerontology* 1982;28:265-70. doi: 10.1159/000212543.
16. Harding S, Gardner A. Fear of falling. *AJAN* 2009; 27: 94-100.
17. Scheffer AC, Schuurmans MJ, van Dijk N, van der Hooft T, de Rooij SE. Fear of falling: measurement strategy, prevalence, risk factors and consequences among older persons. *Age Ageing* 2008;37:19-24. doi: 10.1093/ageing/afm169.
18. Powell LE, Myers AM. The Activities-specific Balance Confidence (ABC) Scale. *J Gerontol A Biol Sci Med Sci* 1995;50A:M28-34. doi: 10.1093/gerona/50a.1.m28.
19. Lamb SE, Jørstad-Stein EC, Hauer K, Becker C; Prevention of Falls Network Europe and Outcomes Consensus Group. Development of a common outcome data set for fall injury prevention trials: the Prevention of Falls Network Europe consensus. *J Am Geriatr Soc* 2005;53:1618-22. doi: 10.1111/j.1532-5415.2005.53455.x.
20. van Kerrebroeck P, Abrams P, Chaikin D, et al. The standardisation of terminology in nocturia: report from the Standardisation Sub-committee of the International Continence Society. *Neurourol Urodyn* 2002;21:179-83. doi: 10.1002/nau.10053.
21. American Heart Association, Recommendations for Physical Activity in Adults and Kids. <https://www.heart.org/en/healthy-living/fitness/fitness-basics/aha-recs-for-physical-activity-in-adults>, 2018 (accessed February 06, 2022).
22. World Health Organization, Obesity: Preventing and Management of the Global Epidemic. Report of the WHO Consultation. World Health Organization. <https://apps.who.int/iris/handle/10665/42330>, 2000 (accessed February 11, 2022).
23. Hauser GA, Huber IC, Keller PJ, Lauritzen C, Schneider HP. Evaluation der klimakterischen Beschwerden (Menopause Rating Scale [MRS]) [Evaluation of climacteric symptoms (Menopause Rating Scale)]. *Zentralbl Gynakol* 1994;116:16-23.



24. Heinemann LA, Potthoff P, Schneider HP. International versions of the Menopause Rating Scale (MRS). *Health Qual Life Outcomes* 2003;1:28. doi: 10.1186/1477-7525-1-28.
25. Espírito Santo J, Marques de Loureiro NE; Brandão-Loureiro V, Aibar-Almazán A, Hita-Contreras F. Psychometric properties and validity of the menopausal rating scale in postmenopausal Portuguese women. *Menopause* 2022 Nov 8. doi: 10.1097/GME.0000000000002104. Online ahead of print.
26. Yardley L, Beyer N, Hauer K, Kempen G, Piot-Ziegler C, Todd C. Development and initial validation of the Falls Efficacy Scale-International (FES-I). *Age Ageing*. 2005;34:614-9. doi: 10.1093/ageing/afi196.
27. Lomas-Vega R, Hita-Contreras F, Mendoza N, Martínez-Amat A. Cross-cultural adaptation and validation of the Falls Efficacy Scale International in Spanish postmenopausal women. *Menopause* 2012;19:904-8. doi: 10.1097/gme.0b013e3182475f6e.
28. Figueiredo D, Santos S. Cross-cultural validation of the Falls Efficacy Scale-International (FES-I) in Portuguese community-dwelling older adults. *Arch Gerontol Geriatr* 2017;68:168-173. doi: 10.1016/j.archger.2016.10.010.
29. Ersoy Y, MacWalter RS, Durmus B, Altay ZE, Baysal O. Predictive effects of different clinical balance measures and the fear of falling on falls in postmenopausal women aged 50 years and over. *Gerontology* 2009;55:660-5. doi: 10.1159/000235652.
30. Montilla-Ibáñez A, Martínez-Amat A, Lomas-Vega R, et al. The Activities-specific Balance Confidence scale: reliability and validity in Spanish patients with vestibular disorders. *Disabil Rehabil* 2017;39:697-703. doi: 10.3109/09638288.2016.1161087.
31. Branco P S. “Validation of the Portuguese Version of the “Activities-specific Balance Confidence Scale”. *Rev Soc Port Med Fis Reabil* 2010;19:20-25. Doi: DOI:10.25759/SPMFR.40.
32. Lajoie Y, Gallagher SP. Predicting falls within the elderly community: comparison of postural sway, reaction time, the Berg balance scale and the Activities-specific Balance Confidence (ABC) scale for comparing fallers and non-fallers. *Arch Gerontol Geriatr* 2004;38:11-26. doi: 10.1016/s0167-4943(03)00082-7.
33. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67:361-70. doi: 10.1111/j.1600-0447.1983.tb09716.x.
34. Herrero MJ, Blanch J, Peri JM, De Pablo J, Pintor L, Bulbena A. A validation study of the hospital anxiety and depression scale (HADS) in a Spanish population. *Gen Hosp Psychiatry* 2003;25:277-83. doi: 10.1016/s0163-8343(03)00043-4.
35. Pais-Ribeiro J, Silva I, Ferreira T, Martins A, Meneses R, Baltar M. Validation study of a Portuguese version of the Hospital Anxiety and Depression Scale. *Psychol Health Med* 2007;12:225-35; quiz 235-7. doi: 10.1080/13548500500524088.
36. Faul F, Erdfelder E, Lang AG, Buchner A. G\*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods* 2007;39:175-91. doi: 10.3758/bf03193146.
37. Hita-Contreras F, Martínez-Amat A, Lomas-Vega R, et al. Relationship of body mass index and body fat distribution with postural balance and risk of falls in Spanish postmenopausal women. *Menopause* 2013;20:202-8. doi: 10.1097/gme.0b013e318261f242.
38. Ahn S, Kim H, So H, Song R. Factors influencing fear of falling in postmenopausal women. *Korean J Women Health Nurs* 2009;15:344-352. doi:10.4069/kjwhn.2009.15.4.344.

39. Silva RB, Costa-Paiva L, Oshima MM, Morais SS, Pinto-Neto AM. Frequência de quedas e associação com parâmetros estabilométricos de equilíbrio em mulheres na pós-menopausa com e sem osteoporose [Frequency of falls and association with stabilometric parameters of balance in postmenopausal women with and without osteoporosis]. *Rev Bras Ginecol Obstet* 2009;31:496-502. doi: 10.1590/s0100-72032009001000005.
40. Zhao J, Liang G, Huang H, et al. Identification of risk factors for falls in postmenopausal women: a systematic review and meta-analysis. *Osteoporos Int* 2020;31:1895-1904. doi: 10.1007/s00198-020-05508-8.
41. Avers D. Functional Performance Measures and Assessment for Older Adults. In D. Avers, Wong ra (Eds.), *Guccione's Geriatric Physical Therapy*, fourth ed. St. Louis, Missouri: Elsevier, 2020: 137-165.
42. Denking MD, Lukas A, Nikolaus T, Hauer K. Factors associated with fear of falling and associated activity restriction in community-dwelling older adults: a systematic review. *Am J Geriatr Psychiatry* 2015;23:72-86. doi: 10.1016/j.jagp.2014.03.002.
43. Hughes CC, Kneebone II, Jones F, Brady B. A theoretical and empirical review of psychological factors associated with falls-related psychological concerns in community-dwelling older people. *Int Psychogeriatr* 2015;27:1071-87. doi: 10.1017/S1041610214002701.
44. Payette MC, Bélanger C, Léveillé V, Grenier S. Fall-Related Psychological Concerns and Anxiety among Community-Dwelling Older Adults: Systematic Review and Meta-Analysis. *PLoS One* 2016;11:e0152848. doi: 10.1371/journal.pone.0152848..
45. Ekblad S, Bergendahl A, Enler P, Ledin T, Möllen C, Hammar M. Disturbances in postural balance are common in postmenopausal women with vasomotor symptoms. *Climacteric* 2000;3:192-8. doi: 10.1080/13697130008500097.
46. Tulmac OB, Simsek G. Assessment of the effects of menopause on semicircular canal using the video head impulse test. *J Obstet Gynaecol* 2021;41(6):939-945. doi: 10.1080/01443615.2020.1819213.
47. Chou KL, Chi I. Reciprocal relationship between fear of falling and depression in elderly Chinese primary care patients. *Aging Ment Health* 2008;12:587-94. doi: 10.1080/13607860802343068.
48. Oh-Park M, Xue X, Holtzer R, Verghese J. Transient versus persistent fear of falling in community-dwelling older adults: incidence and risk factors. *J Am Geriatr Soc* 2011;59:1225-31. doi: 10.1111/j.1532-5415.2011.03475.x.
49. Serrano-Checa R, Hita-Contreras F, Jiménez-García JD, Achalandabaso-Ochoa A, Aibar-Almazán A, Martínez-Amat A. Sleep Quality, Anxiety, and Depression Are Associated with Fall Risk Factors in Older Women. *Int J Environ Res Public Health* 2020;17:4043. doi: 10.3390/ijerph17114043.