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Association between obesity, risk of falls and fear of falling in older women

Associação entre obesidade, risco de quedas e medo de cair em mulheres idosas

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Abstract - The aim of this cross-sectional study was to investigate the association between obesity, risk of falls and fear of falling in older women. Two hundred and twenty-six volunteers (68.05 ± 6.22 years, 68.06 ± 11.79 kg, 1.56 ± 0.06 m) were classified as normal weight, overweight or obese, according to the body mass index. Risk of falls and fear of falling were evaluated using QuickScreen Clinical Falls Risk Assessment and Falls Efficiency Scale – International (FES-I), respectively. Comparisons between groups were conducted using Chi-square and ANOVA One-way tests. The significance level was set at p< 0.05. Obesity was associated with greater probability of falls (p< 0.001), which may be partly explained by decreased muscle strength (p< 0.001) and reaction time (p< 0.001). In addition, significant differences between groups was observed in FES-I score (p< 0.01), with obese women showing more pronounced fear of falling (30.10 ± 8.4) than normal weigh (25. 33 ± 7.11, p< 0.01) and overweight subjects (26.97 ± 7.05, p< 0.05). These findings corroborate previous evidence pointing obesity as a major risk factor for falls. Therefore, health professionals dealing with fall prevention should consider the effects of overweight.

Key words: Accidental falls; Aging; Obesity.

Resumo - *O objetivo deste estudo transversal foi verificar a associação entre obesidade, risco de quedas e medo de cair em mulheres idosas. Duzentas e vinte e seis voluntárias (68,05 ± 6,22 anos; 68,06 ± 11,79 kg; 1,56 ± 0,06 m) foram classificadas em eutróficas, sobrepesadas ou obesas, de acordo com o índice de massa corporal. O risco de quedas e o medo de cair foram mensurados por meio do QuickScreen Clinical Falls Risk Assessment e da Escala de Eficácia de Quedas – Internacional (FES-I), respectivamente. Para comparação entre grupos, empregaram-se os testes Qui-quadrado e ANOVA One-way. O nível de significância adotado foi de p< 0,05. A obesidade foi associada a uma probabilidade de quedas aumentada (p< 0,001), o que pode ser parcialmente explicado pela diminuição da força muscular (p< 0,001) e do tempo de reação (p< 0,001). Adicionalmente, observou-se diferença significativa entre os grupos no escore da FES-I (p< 0,01), sendo que as idosas obesas exibiram um medo de cair mais acentuado (30,10 ± 8,4) que as eutróficas (25,33 ± 7,11; p< 0,01) e as sobrepesadas (26,97 ± 7,05; p< 0,05). Esses achados se agregam a evidências prévias que apontam a obesidade como um importante fator de risco para quedas em idosos. Portanto, profissionais da saúde devem considerar os efeitos do excesso de peso ao lidar com prevenção de quedas.*

Palavras-chave: *Acidentes por quedas; Envelhecimento; Obesidade.*

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INTRODUCTION

The aging process is associated with considerable changes in body composition, mainly characterized by increased fat mass and concomitant reduction in lean mass[1]. Excessive fat accumulation can lead to a condition called obesity, which currently affects about 40% of people over 60 years of age worldwide[2]. It is well documented that this condition is related to important metabolic disorders[3]; but it can also lead to functional impairments[4]. Recent studies have pointed to a possible association between obesity and falls[5,6].

The occurrence of falls in older adults constitutes an important public health problem. It is estimated that approximately 30% of older adults fall at least once a year, an even more frequent occurrence among women[7]. Falls are the second leading cause of accidental death in this population[8], and when they are not fatal they can result in injuries of lesser or greater complexity that lead to restriction of activities of the daily living, loss of functional independence, and increased expenses with hospitalization and rehabilitation[9].

Although obesity is associated with higher occurrence of falls[5,6], the mechanisms responsible for this increased risk are still unclear. The study of factors related to the greater occurrence of falls in this population is therefore relevant and may be useful in the design of preventive interventions. It is well described that falls result from the cumulative effect of multiple deficiencies; therefore, multifactorial evaluation is highly recommended[10]. Recently, Tiedemann et al.[11] developed a multidimensional tool capable of predicting falls in community-dwelling elders: the QuickScreen Clinical Falls Risk Assessment (QuickScreen). It is an instrument of easy clinical application that evaluates the presence of eight risk factors for falls, and may help in the implementation of preventive strategies[11]. Another important aspect to be considered is the individual's concern about the likelihood of falling[12]. The fear of falling is a common condition among older adults that results in functional restriction and is recognized as an important indication of future falls[12]. Among the methods developed for its evaluation, the International Falls Efficiency Scale (FES-I) is the best instrument validated for this purpose[13].

According to an extensive literature review, no previous study has analyzed the aspects responsible for the higher occurrence of falls in obese older adults using the aforementioned instruments. Therefore, the aim of the present study was to verify the association between obesity, risk of falls and fear of falling in older women.

METHODOLOGICAL PROCEDURES

This was a cross-sectional study conducted at the laboratories of the University of Brasília between July 2015 and June 2016. The sample consisted of women aged 60-80 years recruited for convenience in places of access to the target public. All volunteers responded to an eligibility questionnaire,

and those reporting neurological or musculoskeletal disorders that could compromise the assessments, as well as those who underwent surgical procedures within six months were excluded. In addition, the Mini Mental State Examination[14] and the Katz Index[15] were used to ensure that none of the participants had cognitive or functional impairment. After applying the exclusion criteria, 226 older women were included in the present analysis. This study was approved by the Research Ethics Committee of the Faculty of Health Sciences - University of Brasília (protocol No. 1.223.636) and all volunteers signed the Free and Informed Consent Form.

Obesity evaluation

To classify participants as normal weight, overweight or obese, the recommendations of the World Health Organization were followed[16]. Body mass was measured on a digital scale with resolution of 0.1 kg (model E150-INAN, Filizola, São Paulo, Brazil); and stature in a wall stadiometer with specificity of 0.1 cm (WCS / CARDIOMED, Curitiba, Brazil). The evaluation was performed by a single previously trained examiner, following standardized procedures[17]. From the measurements obtained, the body mass index (BMI) was calculated (kg/m^2), where values above 25 kg/m^2 and 30 kg/m^2 are indicative of overweight and obesity, respectively.

In addition, body fat percentage was estimated using the dual energy x-ray absorptiometry - DEXA (General Electric-GE model 8548 BX1L, 2005, DPX lunar type, Encore software 2010, Rommelsdorf, Germany), following previously described procedures[3]. Volunteers positioned themselves on the equipment table in dorsal decubitus position with extended limbs. After analyzing the entire body area, the software estimated the fat mass (FM) and fat-free mass (FFM) values. The DEXA coefficient of variation was 2.1% and 1.9% for FM and FFM, respectively. All measurements were performed by a single, experienced evaluator, and the equipment was daily calibrated according to manufacturer's specifications.

Assessment of the risk of falls

The risk of falls was assessed using QuickScreen[11]. This instrument verifies the presence of eight risk factors for falls: occurrence of falls in the previous year, use of four or more medications, psychotropic medication use, low contrast visual acuity, reduced peripheral sensation and impairment of muscle strength, balance and time of reaction. The final result indicates the number of risk factors that the individual is exposed to, allowing classifying the probability of falls in the next 12 months at one of the following levels: 7, 13, 27, or 49%. The evaluation was performed by a previously trained examiner, following standard recommendations[11]. Briefly, the occurrence of falls was verified by self-report; medications use were analyzed through the inspection of leaflets brought by volunteers according to previous request; and the low contrast visual acuity was measured through the Snellen chart. To assess peripheral sensation, stimuli were applied with a 4.0 g Semmes-Weinstein monofilament over the lateral malleolus of the

dominant leg. Finally, five times sit-to-stand test, near tandem step test and alternate step test were performed to evaluate strength, balance and reaction time, respectively.

Assessment of the fear of falling

Fear of falling was assessed using FES-I[13]. This scale assesses the individual's concern about the possibility of falling during the execution of 16 activities of the daily living, such as bathing, cleaning the house and preparing simple meals. For each of the items, the value of one to four points is assigned, where one represents the absence of concern and four represents extreme concern. The total score varies between 16 and 64 points, and higher values correspond to greater fear of falling. The evaluation was performed as an interview by a previously trained examiner.

Statistical analysis

Initially, variables were checked for normality distribution using the Kolmogorov-Smirnov test. Assuming the assumption of normal distribution, numerical variables were expressed as mean ± standard deviation. Additionally, categorical variables were presented in relative frequency. To compare the risk of falls in normal weight, overweight and obese older women, the Chi-square test was used. The fear-of-fall comparison, in turn, was performed using the one-way ANOVA test with Bonferroni *post-hoc*. The significance level was set at $p < 0.05$. All analyses were conducted in the Statistical Package for Social Sciences (SPSS) software version 20.0.

RESULTS

A total of 226 older women participated in this study. Thirty percent of volunteers were classified as normal weight (BMI <25 kg / m^2), 40% as overweight (25 ≤ BMI <30 kg / m^2) and 30% as obese (BMI ≥ 30 kg / m^2). The sample characteristics are presented in Table 1. There was no difference between groups regarding age and height; however, as expected, obese and overweight women exhibited mass, BMI, and body fat percentage higher than their leaner counterparts.

Table 1. Characteristics of the sample (n = 226). Data are presented as mean ± standard deviation.

	Normal weight (n= 67)	Overweight (n= 90)	Obese (n= 69)	P
Age (years)	68.64 ± 6.94	67.56 ± 6.03	68.10 ± 5.75	£ 0.691
Height (m)	1.56 ± 0.06	1.56 ± 0.06	1.56 ± 0.06	§ 0.873
Weight (kg)	56.01 ± 6,19	67.18 ± 6.38 [c]	80.91 ± 7.61 [a, b]	£ < 0.001
BMI (kg/m²)	22.87 ± 1.66	27.46 ± 1.33 [c]	33.29 ± 2.47 [a, b]	£ < 0.001
Body Fat (%)	38.17 ± 5.01	44.75 ± 3.35 [c]	49.79 ± 3.30 [a, b]	§ < 0.001

BMI: Body mass index. £ Kruskal-Wallis; § One-Way ANOVA. Significant difference (p <0.001): a Obese – normal weight; b Obese - overweight; c Overweight – normal weight.

Figure 1 shows the likelihood of volunteers falling within the next 12 months. Notably, obesity was associated with increased risk of falls (p <0.001). Seventy-seven percent of obese women had risk of 13 or 27%, while the proportion was only 46% among normal weight and 63% among overweight. In addition, only obese volunteers were classified as the worst risk for falls (49%).

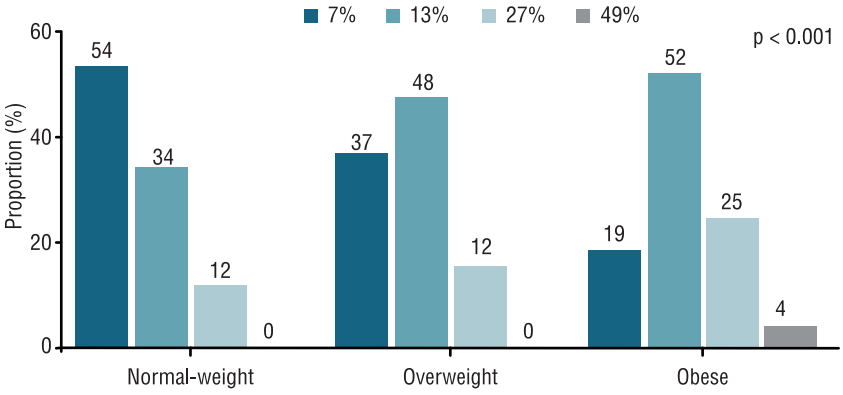

Figure 1. Risk of falls among normal weight, overweight and obese older women. Data are expressed as relative frequency. The association was verified using the chi-square test.

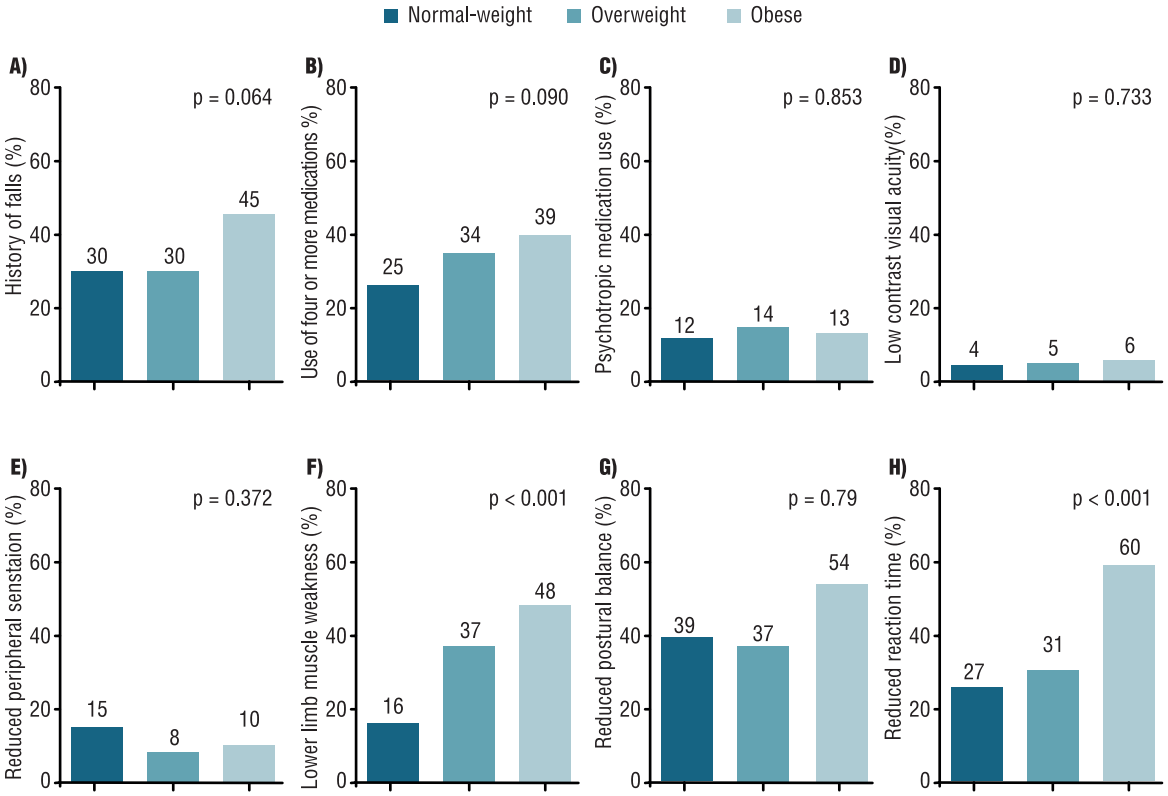

Figure 2. Prevalence of risk factors for falls among normal weight, overweight and obese older women. Data are expressed as relative frequency. The associations were verified using the chi-square test. A) History of falls. B) Use of four or more medications. C) Psychotropic medication use. D) Low contrast visual acuity. E) Reduced peripheral sensation. F) Lower limb muscle weakness. G) Reduced postural balance. H) Reduced reaction time.

The prevalence of risk factors for falls is shown in Figure 2. The only factors associated with obesity were reduced muscle strength (p <0.001) and reaction time (p <0.001), although there was also a trend towards significance for the occurrence of falls in the previous year (p = 0.064) and impaired balance (p = 0.079).

Regarding the fear of falling, the FES-I score was significantly different between groups, and obese women showed more pronounced fear of falling (30.10 ± 8.40) compared to normal weight (25.33 ± 7.11, p = 0.001) and overweight women (26.97 ± 7.05, p = 0.027) (Figure 3).

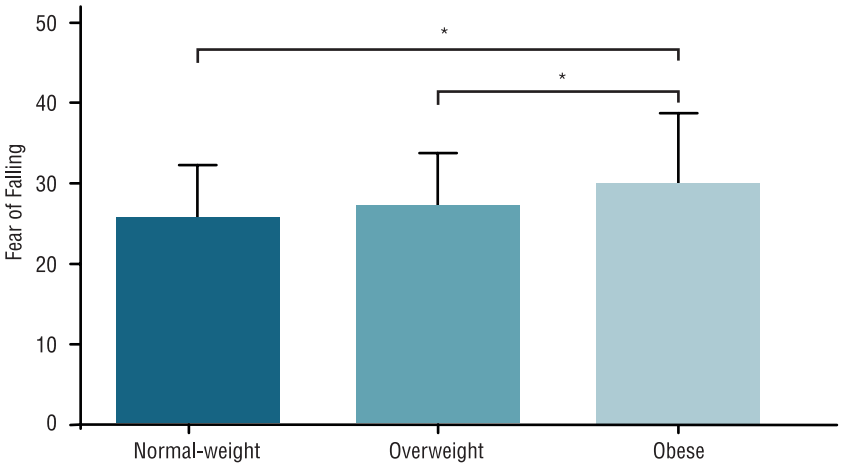

Figure 3. Fear of falling among normal weight, overweight and obese older women. Data are expressed as mean and standard deviation. Between-groups comparisons were performed using the one-way ANOVA with Bonferroni post-hoc test. Between-groups differences are indicated by * (p <0.05).

DISCUSSION

The present study was the first one to analyze the relationship between obesity and the risk of falls and the fear of falling in older women using instruments that are easy to implement in clinical practice. When assessing the risk of falls through QuickScreen, it was observed that obesity was associated with greater probability of future falls, which may be partially explained by the lower limb muscle weakness and the reduced reaction time. FES-I scores also showed more pronounced fear of falling among obese women. Therefore, being overweight is an important condition that should be considered when dealing with falls in older adults.

Epidemiological data indicate an increased risk of falls related to obesity[5,6,18]. Mitchell et al.[5] observed that the prevalence of falls among obese subjects was 30%, whereas among those with normal weight was only 23%. In the present study, these values were higher - approximately 30% of normal weight women fell in the previous year, while the prevalence among obese women was 45%. This higher proportion may be justified by the fact that the sample consisted only of female individuals, an aspect that is known to be related to higher occurrence of falls[7]. Hooker et al.[6] identified that obesity was related to an increase in the risk of falls, which ranged from 24% to 92%, depending on the subject's characteristics, such as age and degree of obesity. In this sense, Himes and Reynolds[18] pointed out that, compared to normal weight subjects, the OR for the risk of falls was 1.12 (95% CI 1.01-1.24) for obesity grade I, 1.26 (95% CI 1.05-1.51) for obesity grade II, and 1.50 (95% CI 1.21-1.86) for obesity grade III.

A determinant factor for the increased risk of falls was the lower limb

muscle weakness, which was tested by the sit-up five times sit-to-stand test. In young individuals, excess weight is associated with increased muscle mass and strength, probably due to musculoskeletal adaptations due to increased overload[19]. The aging process, however, compromises this adaptive mechanism, so that excess adiposity leads to a decrease in muscle strength and increases the risk of physical disability in this population[20]. Muscle fat infiltration may also mediate this relationship[20]. Actually, it was previously observed that the performance of elderly women in the sit-up test had a negative correlation with BMI and also with other body fat indexes[4].

Another aspect related to a greater risk of falls was the reduced reaction time, which was evaluated through the alternate step test. This test requires strength, balance and speed, and is capable of predicting the risk of falls in the elderly[11]. As previously discussed, obesity was associated with a decrease in muscle strength and, although there was no significant difference, 53% of obese women showed reduced balance. Therefore, it seems natural that excess weight is related to a poor performance in this test.

Obesity was also associated with more expressive fear of falling, which results from a worse performance in the above-mentioned tests[21]. Corroborating the findings of the present study, Jeon et al.[22] evidenced a relationship between BMI and fear of falling in a sample of 351 old Koreans; however, the risk of falls was not the aim of that study. Conversely, Mitchell et al.[5] observed higher occurrence of falls in obese elderly, but the fear of falling did not differ among BMI strata. It should be observed; however, that this outcome was evaluated through a dichotomous response to a single question; which method was shown to be less sensitive than other measures, such as FES-I[13], which was used here. In fact, scores higher than 23 in FES-I are already indicative of an increased concern with the probability of falls[23] and, therefore, both normal weight and obese women were highly afraid of falling, although it was even higher in obese women. Such difference may reflect the recognition of being exposed to an increased risk of falls[24].

Given the above, health professionals should be concerned about the occurrence of obesity in elderly individuals. Without proper control, the aging process results in accumulation of adipose tissue[1], generating negative health consequences. In addition to metabolic and functional consequences[4], already well described in literature, the results of this study indicate that excess body adiposity is associated with risk of falls and a fear of falling in older women. Thus, the prevention and treatment of obesity could, among other beneficial aspects, reduce the occurrence of falls in this population. Taking into account that obesity results from positive energy balance, intervention strategies should emphasize food re-education and the promotion of adequate levels of physical activity[16]. In addition, the adoption of specific activities for muscle strengthening and improvement of the reaction time is also recommended. These practices should be guided by a multidisciplinary team.

The present study presents strengths and limitations. The use of validated instruments of easy clinical application and the originality of find-

ings are strengths. The fact that the sample was composed of functionally independent older women, on the other hand, may raise the question if the results apply to the elderly population in general. Moreover, the cross-sectional nature of the research does not allow for the establishment of cause and effect relationships. Therefore, although this article adds information to literature in this area, further studies should be conducted to determine whether interventions to control obesity can minimize the risk of falls in elderly individuals.

CONCLUSIONS

Based on the results presented, it is possible to conclude that obesity is associated with risk of falls and fear of falling in older women, which may be partially explained by the lower limb muscle weakness and the reduced reaction time. Thus, health professionals should consider the effects of increased bodyweight when dealing with prevention of falls in the elderly.

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