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Article

The Impact of a Health Education Program on Fear of Falling and Fall Risk in Elderly People from UATI: A Clinical Trial

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ABSTRACT

Aging leads to morphofunctional changes that trigger a decline in functional mobility and an increased risk of falls. In light of the above, the present study aims to test the hypothesis that a health education program reduces the fear of falling and the risk of falls in elderly individuals from a University for the Third Age, who do not exhibit cognitive decline and are capable of performing physical tests and responding to questionnaires. This is a longitudinal, experimental study, conducted through a single-arm clinical trial, of the before-and-after type within the same group and with randomization of the evaluator groups, carried out from October to December 2023, in the northeastern region of Brazil. To assess the fear of falling, the Falls Efficacy Scale-International-Brazil (FES-I-BRASIL) was used, and for the evaluation of functional mobility, the Timed Up and Go test was employed. (TUG). The intervention lasted eight weeks, conducted over two days a week, consisting of in-person activities and activities carried out in the homes of the elderly. The health education program took place through theoretical and practical classes related to fall prevention activities and physical exercise, as well as home activities using educational booklets. Out of fifty potential participants, thirty-three (average age 71 ± 6.3 years) were selected, with 99.7% being female. The elderly showed a significant improvement in functional mobility ($p = 0.02$) and fear of falling ($p = 0.01$) after the health education program intervention; however, when dichotomized into age strata, it was possible to identify that only the group of elderly individuals aged 70 years or older showed a significant improvement in functional mobility ($p < 0.01$). This study suggests that a health education program for the elderly improves functional mobility, resulting in a reduction in the risk of falls and the fear of falling.

Keywords: elderly; fall accidents; health education; physical exercise.

RESUMO

O envelhecimento gera alterações morfofuncionais que desencadeiam declínio da mobilidade funcional e aumento do risco de quedas. Diante disto, o presente estudo tem como objetivo testar a hipótese de que um programa de educação em saúde reduz o medo de cair e o risco de quedas em idosos de uma Universidade Aberta à Terceira Idade, que não apresentam declínio cognitivo e com capacidade de realizar testes físicos e responder a questionários. Trata-se de um estudo longitudinal, experimental, por meio de um

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ensaio clínico de braço único, do tipo antes e após a intervenção no mesmo grupo e com randomização dos grupos de avaliadores, realizado no período de outubro a dezembro de 2023, na região nordeste do Brasil. Para avaliar o medo de cair foi utilizada a *Falls Efficacy Scale-International*-Brasil (FES-I-BRASIL) e para avaliação da mobilidade funcional o *Timed Up and Go (TUG)*. A intervenção teve duração de oito semanas, desenvolvida em dois dias por semana, composta por atividades presenciais e atividades realizadas no domicilio dos idosos. O programa de educação em saúde ocorreu por meio de aulas teórico-práticas, relacionadas às atividades de prevenção de quedas e a prática de exercício físico, além das atividades no domicílio utilizando cartilhas educativas. Dos cinquenta potenciais participantes, trinta e três (média de idade 71 ± 6,3 anos) foram selecionados, sendo 99,7% do sexo feminino. Os idosos apresentaram melhora significativa da mobilidade funcional ($p = 0,02$) e do medo de cair ($p = 0,01$) após a intervenção do programa de educação em saúde, porém, ao dicotomizar em estratos etários, foi possível identificar que somente o grupo de idosos com 70 anos ou mais apresentou melhora significativa da mobilidade funcional ($p < 0,01$). Este estudo sugere que um programa de educação em saúde para idosos, melhora a mobilidade funcional, repercutindo na redução do risco de quedas e do medo de cair.
Palavras-chave: idoso; acidentes por quedas; educação em saúde; exercício físico.

Introduction

The current global landscape shows a significant increase in demographic transition characterized by rising life expectancy and the consequent aging of the population. This scenario implies new demands, as the aging process causes biopsychosocial changes that can lead to greater vulnerability among the elderly (Carvalho et al. 2018. The morphofunctional changes caused by aging tend to progressively lead to a decline in neuromuscular activity, osteoarticular integrity, sensory and cognitive functions, which increases the the risk of falls and compromises the health and the quality of life of the elderly. It is estimated that worldwide, about 30% of people aged 65 or older experience falls annually (Junior et al. 2022).

There are some factors that predispose elderly individuals to falls, such as intrinsic or extrinsic factors. Intrinsic factors are characterized by changes resulting from aging, such as sensory, cognitive, and functional alterations that promote changes in balance and gait, while extrinsic factors are associated with risks present in the environment, such as uneven surfaces, slippery floors, inadequate lighting, stairs without handrails, loose rugs, among others. In the elderly population, there are additional factors that influence the occurrence of falls, such as advanced age, being female, having a previous history of falls, low education level, functional decline, decreased self-care, and difficulties in performing Activities of Daily Living (ADL) (Mendonça et al. 2023; Souza et al. 2017).

Falls in old age correspond to an important global public health issue, being considered one of the most concerning geriatric syndromes due to their high incidence and their impacts on the health of the elderly. In Brazil, the prevalence of falls among elderly individuals living in urban areas is 25%, according to the ELSI-Brasil 2023 study, which emphasizes the association of falls with multidimensional factors such as being female, being 75 years old or older, and the fear of falling, as well as issues related to inadequate public road conditions. (ELSI-Brasil 2023). In addition to physical injuries such as fractures, abrasions, and bruises, falls can trigger the fear of falling again. This fear of falling is recognized as a syndrome with serious implications such as a decline in functional mobility, a reduction in autonomy and functional independence, consequently leading to psychological harms such as social isolation, a sense of incapacity, and depression. (Antes 2013).

Among the preventive measures, educational interventions stand out as having a fundamental role in reducing the risk of falls and the fear of falling in the elderly. Health education aims to provide knowledge about risk factors, preventive measures against falls, strategies to enhance functional mobility, and both static and dynamic balance, helping to overcome the fear of falling, increasing autonomy and self-confidence, and consequently improving the quality of life for the elderly (Carvalho et al. 2018. When health education is associated with physical exercise, it is believed that the therapeutic strategy becomes more effective in minimizing the fear of falling and the risk of falls (Jung et al. 2009; Ximenes et al. 2021; Dantas & Muñoz 2024). Given the relevance of the proposed topic, the present study aimed to test the hypothesis that a health education

program reduces the fear of falling and the risk of falls in elderly individuals at a University Open to the Third Age – UATI.

Methodology

This is a prospective study, through a single-arm clinical trial, of the before-and-after intervention type, with randomization of the evaluator groups and having as the main outcomes the fear of falling and the risk of falls in the elderly. The sampling procedure used was non-probabilistic, specifically convenience sampling, consisting of elderly individuals registered in the Open University for the Third Age program – UATI of the State University of Bahia – UNEB, in the Education Department Campus VII, in the municipality of Senhor do Bonfim-Ba, in the northeastern region of Brazil, during the period of October and November 2023. This study was conducted using data from a larger project developed by researchers affiliated with the study and research group on quality of life and healthy aging (QualES) at UNEB, DEDC-VII, which aims to assess the effect of a multidisciplinary program on the health and quality of life of the elderly. The inclusion criteria were to be of both sexes, to be 60 years of age or older, and to be enrolled in UATI. The exclusion criteria included presenting cognitive decline according to the Mini-Mental State Examination – MMSE (Bertololucci et al. 1994), having visual and/or auditory deficits that would prevent the individual from performing physical tests or responding to the questionnaire, requiring assistive devices for walking, and not having a minimum attendance of 70% in theoretical-practical activities, following the research participation protocol (Cook-Shumway et al.). 2007).

This research is part of a larger study titled: "Effects of a multidisciplinary approach program on the health and quality of life of the elderly," which received approval from the Ethics Committee for research involving human beings at the State University of Bahia – UNEB, with CAAE: 25875819.8.0000.0057. The collection only began after the participants signed the Informed Consent Form (ICF). The ethical principles of research involving human beings were upheld in accordance with the ethical principles of Resolution 466/12 of the National Health Council. The researchers involved in the study committed to maintaining total confidentiality and privacy of the data, aiming for the absolute preservation of the anonymity of the participants in this research.

The evaluators who participated in the research were trained through standardized instructions for conducting the tests, as well as for fitting the elderly individuals into he inclusion and exclusion criteria. The evaluators were also randomized, meaning they were allocated randomly according to a sequence of random numbers generated by the Research Randomizer (https://www.randomizer.org/). This randomization generated two groups (group 1 and group 2), and each group was unaware of the test results of the group to which it did not belong, in order to avoid evaluation bias. Group 1 was responsible for the initial contact, which involved the presentation and invitation for the elderly from UATI to participate in the research project, as well as the application of the TCLE, MEEM, the semi-structured questionnaire, and the FES-I-Brazil scale.

The research only began after the participants signed the Informed Consent Terms (ICT). Next, through individual interviews, a semi-structured questionnaire was administered, where data regarding the sociodemographic, anthropometric, and clinical characteristics of the elderly were collected. The assessment of body mass was obtained using a Welmy® brand scale, with a capacity of 150 kilograms (kg); the height, in meters (m), was measured using a vertical stadiometer fixed to the scale, and the Body Mass Index (BMI) was calculated by dividing the weight in kilograms by the height in meters squared.

The first test administered was the MEEM, which assessed the presence or absence of cognitive changes, with the absence of cognitive deficits determined by scores greater than 13 for illiterates, 18 for individuals with 1 to 7 years of schooling, and 26 for those with eight years or more of schooling, according to (Bertolucci et al.

1994). Subsequently, an interview was conducted using the Falls Efficacy Scale-International-Brazil (FES-I-BRASIL), which is an adapted and validated version by Camargos (2010), based on psychometric properties for the Brazilian population derived from the Falls Efficacy Scale – International. (FES-I). The FES-I-BRASIL assesses the fear of falling in 16 distinct daily activities, with scores ranging from 16 points for individuals with no concern about falling to 64 points for individuals with extreme concern (Camargos et al.). 2010).

After the first evaluation, group 2, without knowledge of the previous assessments, was responsible for administering the functional mobility test – "Timed Up and Go (TUG)." This test is characterized by including more specific stimuli to assess agility and balance, based on the combination of various everyday actions. Mobility also establishes itself as a fundamental point of functional assessment, as it is closely related to the likelihood of falls and has, consequently, a negative impact on functional capacity. Thus, a mobility test that can be used to assess the functional capacity of the elderly is the Timed Up and Go (TUG) (Shumway-Cook et al. 2000). The TUG methodology is based on assessing the speed of execution in standing up from an armchair, walking three meters forward, turning around, walking back, and sitting down in the chair again, thus characterizing a set of typically routine actions that are fundamental for the independent mobility of the elderly. Performance is compromised by reaction time, muscle strength of the lower limbs, dynamic balance, and ease of walking. The time spent is measured by the evaluator using a stopwatch, starting from the verbal command "go." Time values less than 10 seconds suggest individuals who are completely free and independent; those who complete the test between 10 and 19 seconds are considered independent, while those in the 20 to 29 seconds range fall into a category referred to as the "gray zone," meaning they show difficulties with daily living tasks and a reduction in functional capacity. Individuals who score 30 seconds or more tend to be completely dependent for many basic and instrumental activities of daily living (Shumway-Cook et al.). 2000). The technique for conducting the test was presented to the participants beforehand, with the instruction to walk safely, as quickly as possible, but without running. After a thorough explanation regarding the proper conduct of the test, it was first carried out to ensure learning, and only in the second attempt was the elderly person evaluated. During the test, one of the examiners stayed close and attentive to the individual, ensuring their safety without interfering in the execution of the test.

Regarding the intervention, initially, all the elderly participants attended a 40-minute lecture that explained the entire experimental procedure. The health education program developed both theoretically and practically, consisting of educational activities focused on fall prevention and guidance on the proper practice of physical exercise. The program lasted eight weeks, being conducted two days a week, with in-person and supervised activities held in appropriate rooms for physical activities, in addition to activities carried out in the seniors' homes after training for their execution, supported by the use of educational booklets. The daily sessions lasted two hours, with one hour dedicated to fall prevention activities and one hour focused on physical exercise activities. The fall prevention activities consisted of classes related to the risk and prevention of falls in the home environment and outdoor areas, which included guidance and training on the adaptation of furniture and objects in the home, the use of appropriate footwear and safety devices. There were also theoretical and practical classes on the importance of physical exercise for fall prevention, as well as guidance and training for the proper execution of exercises at home and the application of adherence strategies to them.

Regarding activities related to physical exercise, in addition to in-person training twice a week, lasting one hour each day, the elderly were advised and encouraged to replicate the exercises at home for at least two more days. These exercises were based on a previously validated booklet that presents a home exercise program for the elderly (Brandão et al. 2018) and demonstrated improvements in sleep quality and quality of life through randomized clinical trials. This booklet, which was made available to the elderly via WhatsApp, presents a

combination of aerobic, muscle strengthening, balance, coordination, and flexibility exercises, prioritizing the ones that involve large muscle groups, with a planned execution time of 40 minutes and performing 2 to 3 sets of 5 to 15 repetitions for each exercise, at a target effort rate of 13-15 ("somewhat hard" to "hard") on the Borg perceived exertion scale of 6 to 20 points. (Borg 1982). The exercises were performed using the participant's own body weight and with the help of some low-cost equipment (for example, recyclable plastic bottles to mark the course, sticks, and weights of 1 and 2 kg for resistance exercises), and were structured as follows: warm-up, aerobic, resistance, balance and coordination, and stretching exercises. The application of the booklet took place through its projection on a large screen positioned on the wall of the room, allowing all the elderly to see it. Guidance was provided on how to perform each of the exercises, which were then carried out by everyone, under the supervision of four appropriately trained individuals. The aim of this training, with the booklet, was to enable learning, allowing the elderly to reproduce, appropriately and safely, in their homes. After 8 weeks of intervention, a data collection was conducted again to compare the results before and after the intervention.

According to the convenience sampling criterion, the statistical power of the study was calculated using the WinPepi calculator (publichealth.jbpub.com/book/gerstman/winpepi.cfm). With a sample size of 33 people, considering the variable related to functional mobility (TUG), where the standard deviation of the first measurement moment (before the intervention) was 1.9 seconds and of the second measurement moment (after the intervention) was 1.6 seconds, to detect a difference of 0.6 seconds, with a correlation coefficient of 0.82 and a significance level of 5%, resulting in a power of 86.7%. An assessment of the delta normality of the values for each analyzed variable was conducted (delta = values obtained after the intervention minus the values obtained before) through the analysis of the histogram, mean, median, standard deviation, skewness, kurtosis, and confirmed with the Shapiro-Wilk and Kolmogorov-Smirnov tests. Next, the data were subjected to descriptive analysis through absolute and percentage frequencies for categorical variables, as well as measures of central tendency and dispersion for numerical variables. Bootstrapping procedures (1000 resamplings; 95% BCa CI) were carried out to achieve greater reliability of the results, to correct for deviations from normality in the sample distribution, and to address differences in group sizes. (Haukoos & Lewis 2005). Due to the normal distribution of the analyzed variables, parametric statistics were used, and intragroup comparisons were conducted using the paired Student's t-test. The subgroup analysis of age strata was pre-specified in the study protocol, where the sample was dichotomized and the analysis was conducted before and after the intervention in each of the two age groups. The magnitude of the difference between the groups was assessed through effect size, calculated using Cohen's methodology (Cohen's d), which represents how much two means differ in terms of standard deviations. (Cohen 1988). The graphical representation was used through the boxplot to demonstrate the behavior of the continuous variables before and after the intervention period. The significance level set for the analyses was $\alpha < 0.05$, and the statistical procedures were analyzed and processed using the Statistical Package for the Social Sciences – SPSS® (version 21.0).

Results

Initially, 50 potential elderly participants involved in the UATI Program were invited. Of these, two refused to participate in the study, 11 were excluded for not meeting the eligibility criteria, and four for not having a minimum attendance of 70% in health education activities. Thus, 33 elderly individuals participated in the interventions and evaluations. A summary of the participant flow throughout the study course is presented in Figure 1.

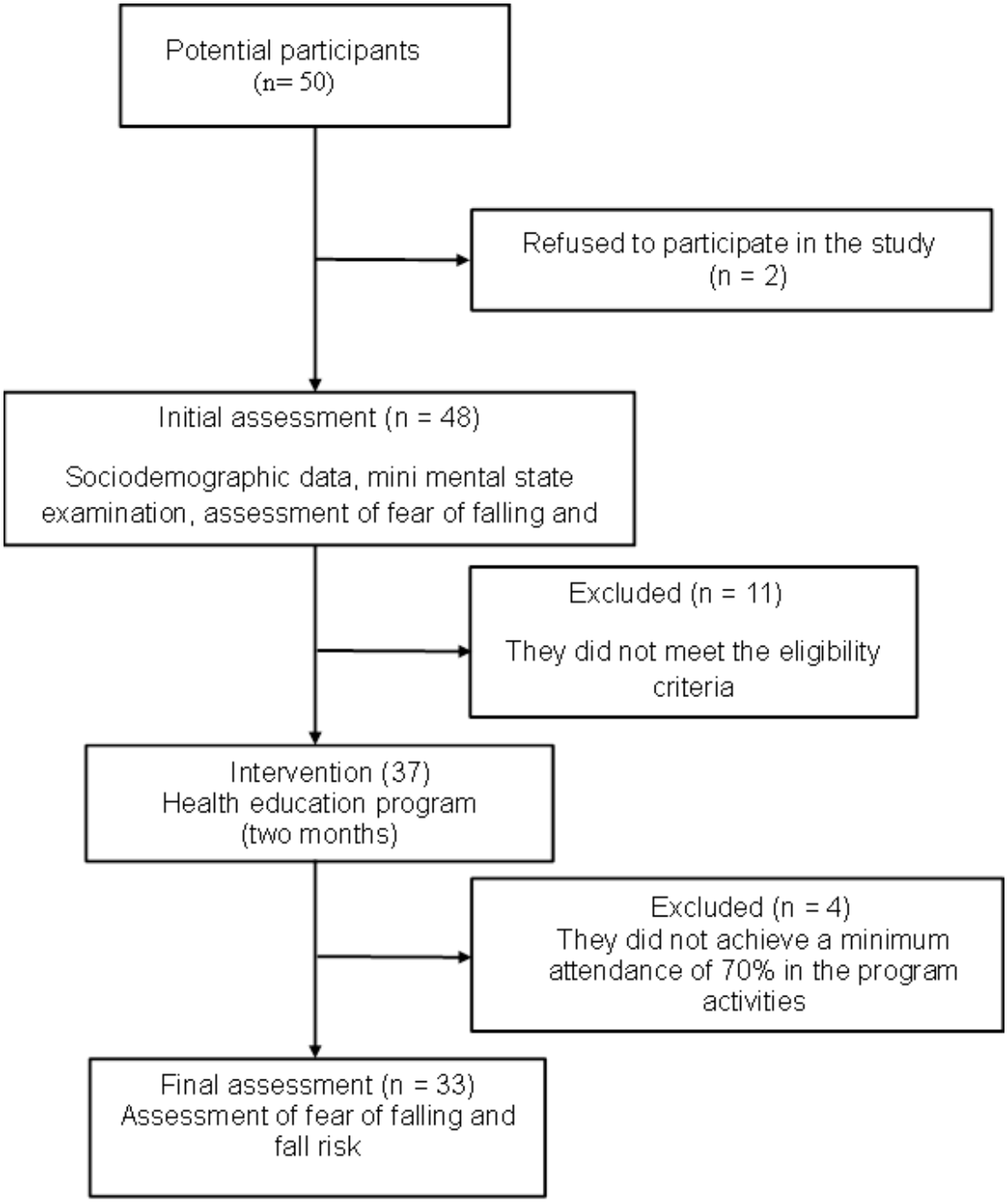

Figure 1. Flowchart of the study.

The sample was predominantly composed of women (97.7%), with an average age of 71 ± 6.3 years, exhibiting low educational levels (57.6% ≤ elementary education), low per capita income (81.8% ≤ 2 minimum wages), and mostly living with family members (75.8%), with 69.7% had a weight classified as above normal. Among the self-reported morbidities, the most prevalent was anxiety at 63.6%, and the prevalence of multimorbidity (defined as ≥ 2 morbidities) was 38.2%. (Tabel 1).

Table 1. Sociodemographic and clinical characteristics of the elderly involved in the study.

Variables	n (%)	Mean± standard deviation
Sex (n (%) women)	32 (97,7)	
Age		71 ± 6,3
Education		
Illiterate	2 (6,1)	
Fundamental	17 (51,5)	
Medium	14 (42,4)	
Marital status		
Single	6 (18,2)	
Married	7 (21,2)	
Widow	17 (51,5)	
Divorced	2 (6,1)	
Amasiada (o)	1 (3,0)	
Monthly per capita income		
< 1 salary	14 (42,4)	
1 a 2 salary	13 (39,4)	
> 2 a 3 salary	4 (12,1)	
> 3 salary	2 (6,1)	
Home arrangement		
Lives with family members.	25 (75,8)	
	8 (24,2)	
Live alone		
Self-reported morbidities Anxiety		
Osteoarthritis/arthritis	21 (63,6)	
High blood pressure	16 (48,5)	
Diabetes	15 (45,4)	
	12 (36,4)	
BMI (Kg/m2)		28,1 ± 5,7
Normal (18,5 a 24,9)	10 (30,3)	
Overweight (25,0 a 29,9)	14 (42,4)	
Obese (≥ 30)	9 (27,3)	

Note: SD = standard deviation; BMI = body mass index; MW = minimum wage at the time of the research (in Brazilian reais) = R$ 1.320,00.

Figure 2 demonstrates that the elderly showed a significant improvement in functional mobility, changing from 9.7 ± 1.2 to 9 ± 1.6, with an average reduction of 0.7 seconds ($p = 0.02$), when comparing measurements taken before and after the intervention of the health education program ($t(32) = 2.440$, $p = 0.02$). The effect size was medium (Cohen's $d = 0.425$).

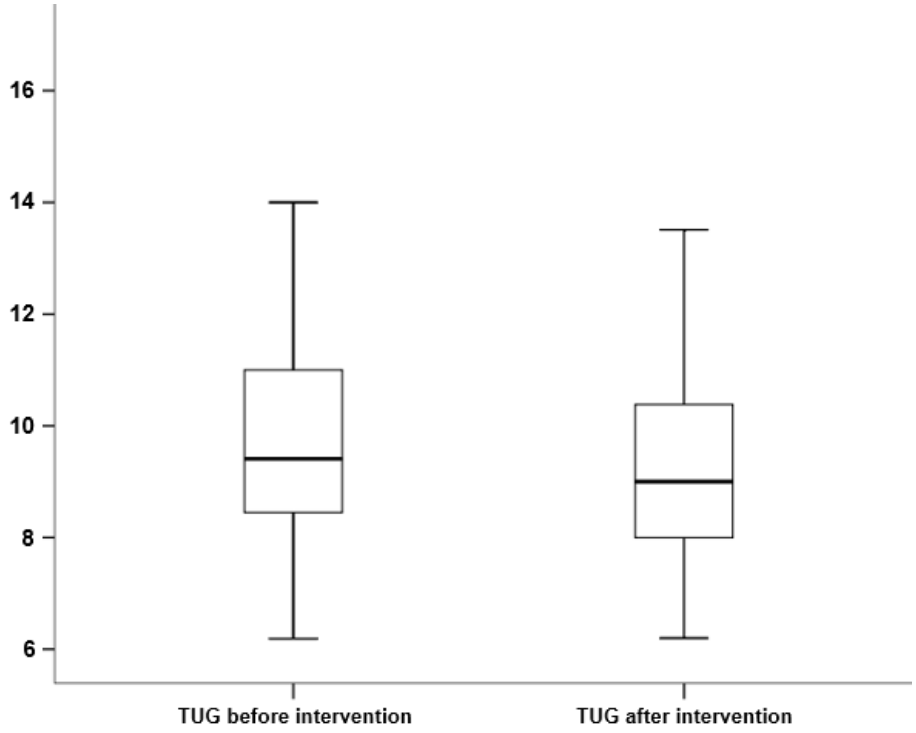

Figure 2. Distribution of functional mobility comparison between the pre- and post-intervention for elderly participants in the study.

The results showed that the score related to the fear of falling, measured by the FES scale, was lower in the post-test (M = 29.2; SD = 8.3) compared to the pre-test (M = 31.0; SD = 8.8), indicating a statistically significant reduction after the intervention (t(32) = 2.656; p = 0.01), as illustrated in Figure 3. The effect size of the difference was medium (Cohen's d = 0.462).

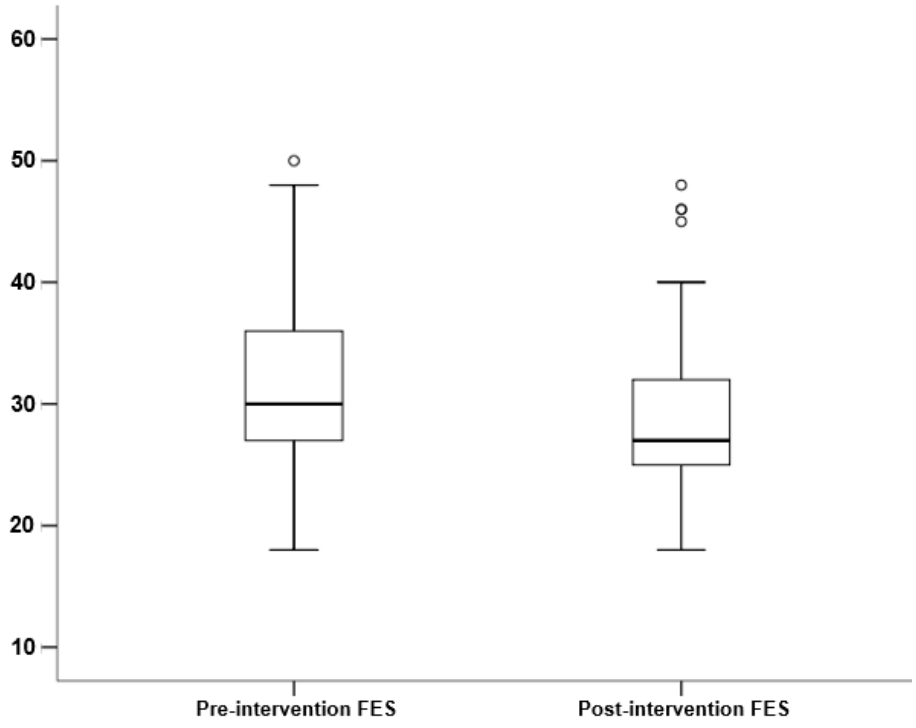

Figure 3. Box plot distribution comparing the fear of falling between pre- and post-intervention for elderly participants in the study.

As demonstrated in Figure 4, by dichotomizing the sample into two age strata (60 to 69 and 70 or older) and conducting intragroup analyses between the moments before and after the intervention in each group, it was possible to identify that only the group aged 70 and older showed a statistically significant improvement in functional mobility, with a pre-test result (M = 10.0; SD = 1.9) and post-test results (M = 9.1; SD = 1.6); ($t(19) = 2.626$; $p = 0.017$). The effect size of the difference was medium (Cohen's $d = 0.602$).

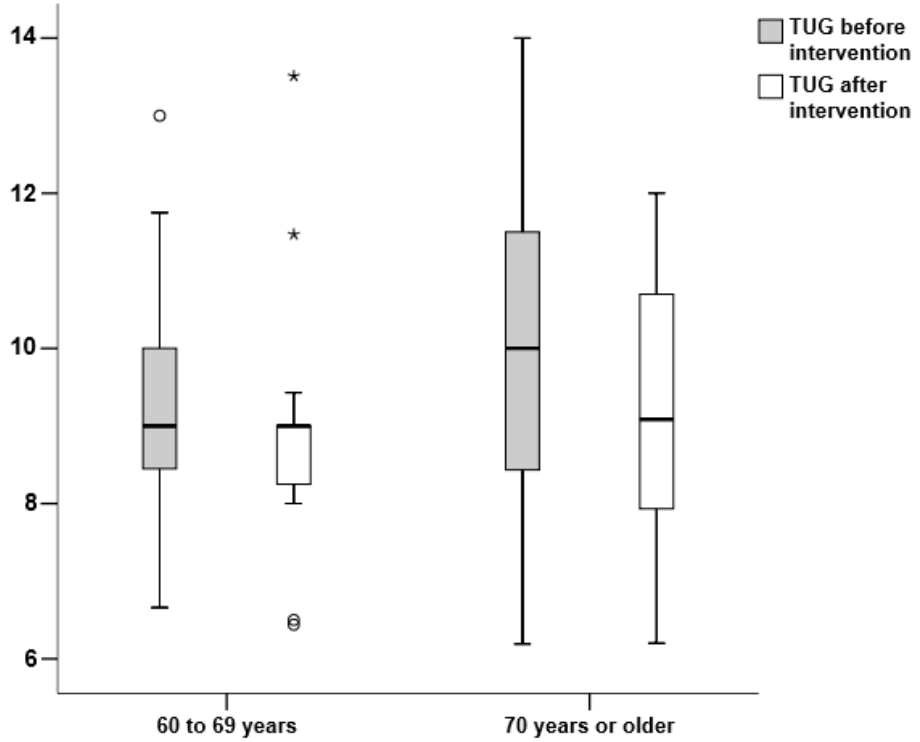

Figure 4. Distribution of the intragroup comparison regarding the execution time of the TUG before and after the intervention, across different age strata of the elderly. (60 a 69 e 70 ou mais).

Discussion

The results of this research reveal that elderly individuals, by participating in a health education program, showed a significant reduction in the risk of falls and fear of falling, which is consistent with the research hypotheses and represents a clinically relevant advancement. The aging process leads to morphofunctional changes that trigger a decline in functional mobility, increasing the risk of falls and the fear of falling (Balboa-Castillo et al. 2011; Chodzko-Zajko et al. 2009; Gil et al. 1995). However, there are strategies that can minimize these changes (Brandão et al. 2021; Garcia et al. 2020; Martins et al. 2016). In the present study, a health education program based on theoretical and practical activities for fall risk prevention was used, proving to be safe and feasible, with a high attendance rate of elderly participants in the proposed in-person activities (≥ 70%).

The results of the present study demonstrated the effectiveness of a health education program on the functional mobility of the elderly, aligning with previous research that evaluated the feasibility and effectiveness of a community fall prevention program through the implementation of practical activities and health education classes on risks and fall prevention, resulting in improvements in functional mobility and a consequent reduction in the risk of falls (Cook-Shumway et al. 2007; Freiberger 2013). Educational interventions combined with physical exercise improve functional capacity and have a preventive effect on the fall incidence, promoting quality aging. Recent studies have highlighted the importance of educating the elderly about safety measures

against falls while encouraging them to engage in physical exercise (Mendonça et al. 2023; Oliveira et al. 2021; Abdala et al. 2017).

In this research, in addition to practical activities and theoretical classes, booklets were distributed with a combination of exercises to be performed at home, which brought positive impacts to the research results. Even at home, the elderly carried out the recommended exercises, enhancing muscle strength, coordination, balance, and, consequently, functional mobility. This corroborates findings from a significant study conducted in Nuremberg, Germany, which used a therapeutic strategy consisting of discussion sessions addressing the risk of falls and their prevention, associated with the practice of physical exercise and the distribution of a booklet containing guidelines and a schedule of exercises to be performed at home (Cook-Shumway et al. 2007).

The present study demonstrated that, as educational and practical interventions were applied, the elderly showed an increase in mobility and gained confidence, consequently reducing their fear of falling. This aligns with other studies where treatments involving specific exercises and health education aimed at fall prevention were implemented (Meléndez-Moral et al. 2013 & Siegrist et al. 2016). Improved functional mobility generates self-confidence, making the elderly more active and encouraging greater participation in daily life activities, thereby improving their quality of life (Sherrington et al. 2019). A meta-analysis showed that physical exercise, combined with health education classes, is more effective than an exclusive exercise program, as the fear of falling is influenced not only by physical issues but also by psychological problems and cognitive factors (Jung et al. 2009). Thus, it becomes evident the effectiveness of the health education intervention composed of activities aimed at fall prevention, worked alongside physical exercise practices, in reducing the fear of falling among the elderly.

The analysis of age subgroups conducted in this study showed a significant improvement in functional mobility only among elderly individuals aged 70 years or older. This result is justified by the fact that older seniors, due to initially having greater impairment in functional mobility, tend to show more positive outcomes after implementing therapeutic strategies aimed at improving muscle strength, balance, coordination, body awareness, and reaction time, when compared to younger seniors who already have better functional mobility from the outset (Prado et al., 2010; Silva et al., 2017). This study corroborates a longitudinal study that followed elderly individuals over 15 years and demonstrated that the age of 70 years or older is a risk factor for the decline in functional mobility, associated with better recovery capacity (Nascimento et al. 2022). The results of this study should be interpreted considering some limitations, such as the use of a non-probabilistic sample, the absence of a control group, a short follow-up period, and a sample composed exclusively of women, which is justifiable due to the feminization of aging (Austad et al., 2015).

Conclusion

The results obtained in this study showed that a health education program for the elderly, which included theoretical and practical activities, was effective in improving functional mobility, leading to a reduction in the risk of falls and the fear of falling. Therefore, it can be considered an effective and safe therapeutic strategy that is non-pharmacological, low-cost, and easy to implement.

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