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The Effect of Fall-Prevention Multimedia Training on the Fear of Falling, Home Safety, and the Quality of Life in Older Adults: A Randomized, Parallel, Controlled Trial

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Abstract

Background: Falling is a common aging-associated problem. Over one-third of older adults have experienced at least one episode of falling, and its prevalence increases with age.
Objectives: This study was conducted to determine the effect of fall-prevention multimedia training on the fear of falling, home safety, and the quality of life in older adults presenting to a designated healthcare center.
Methods: Design: Parallel, double-blind, randomized, controlled trial. Setting: The orthopedic outpatient clinic of Dena Hospital in Shiraz, Fars province, Iran. Participants: 100 older adults, including 50 randomly allocated to the intervention group (multimedia training) and 50 to the control group (standard teaching) by permuted block randomization. Measurements: For data collection, a demographic information form, the fear of falling inventory, the home falls and accidents screening tool (HOME FAST), and LEIPAD (an instrument for assessing the quality of life in older adults) were completed before and three months after the intervention. The level of significance was set at 0.05.
Results: The comparison of the pre-and post-intervention scores of the three assessed outcomes between the study groups showed a significant difference between the mean scores of home safety before and after the intervention ($P < 0.001$) in the intervention group; however, there were no significant differences in the scores of fear of falling ($P = 0.30$) and quality of life ($P = 0.32$). In the control group, there were no statistically significant differences in the mean scores of the three outcomes before and after the intervention. Calculating the standardized mean difference revealed the significant effect of the intervention on home safety (Cohen's $d = 0.84$, 95% CI: 0.43 - 1.3).
Conclusions: Given the potential effectiveness of multimedia training in the improvement of older adults' fear of falling and quality of life, especially concerning home safety, this type of training should be emphasized in future educational programs.

Keywords: Education, Falling, Home Health Care, Multimedia, Older Adults

1. Background

The aging population is the most important anthropological phenomenon of the 21st century. The global population of adults aged 60 and over is expected to increase to two billion in 2050 from 900 million in 2015 (1). Iran's older adult population also increased from 7.22% in 2006 to 8.20% in 2011 (2). Falling is one of the major problems faced by people over 60 years old. More than one-third of people over 65 experience falls at least once a year, with 30% to 50% of the cases leading to minor injuries and 5% to 10% resulting in severe injuries (3, 4). Falling is an incident that causes someone to inadvertently come to rest on the ground or floor or at other lower surfaces, not because of a severe acute incident. Falling is the second leading cause of death worldwide due to unintentional accidents and injuries. Every year, about 646,000 people die from falling, with more than 80% of the incidents occurring in low- and middle-income countries (5). Falls can also lead to hospitalization, disabilities, lower quality of life, loss of autonomy, and admission to nursing

homes (6). They seriously threaten the quality of life of older adults and often reduce the individual's ability for self-care and physical and social functioning (7). Even in the absence of falls, fear of falling can reduce self-efficacy and intensify the symptoms of anxiety and depression (8). Fear of falling is experienced by 20% to 39% of people with a history of falling and can lead to restrictions on future activities (7).

Falling is a multifactorial phenomenon that involves internal and external factors. This phenomenon is associated with intrinsic factors such as muscle weakness, behavioral and cognitive impairment, and the inability to preserve or restore balance. The extrinsic factors include environmental stimuli such as lighting, walking surface, slippery carpets, and step length. Various environmental factors contribute to falls in older adults, including inadequate lighting, uneven ground, a slippery surface, unstable carpets, step length, poorly-designed stairs, obstacles, and barriers, absence of handrails in bathrooms and hallways, poor body posture, unsuitable clothing and footwear (9). As more than 72.8% of falls occur at home due to slippery surfaces, sleepiness, or changes in conditions, improving the home environment for this age group is crucial (10). Few studies have been conducted on home modifications for older adults to prevent falls. According to the World Health Organization (WHO), fall prevention programs for older adults should be based on the following items: Screening the risk of falls within the home and living environment and their modification, medication review and management, treatment of low blood pressure and visual problems, and vitamin D and calcium supplementation (5). A meta-analysis on this subject showed that multi-component interventions for older adults based on their fall risk profile could significantly decline the rate of falls and their frequency (11). Various interventions, including home modifications, have been proposed to reduce the risk of falls (12). However, despite its numerous benefits, such as the ability to combine text, sound, and image, extensive training opportunities to achieve desired levels of proficiency, the facilitation of participation and repetition in courses, program flexibility, increased user excitement and satisfaction during interactive learning processes compared to traditional learning (13-15), multimedia training has rarely been utilized for this purpose (16-18). In a study using multimedia content to implement a fall protection program, the level of knowledge on the threat of falling and fall preventive behaviors significantly improved after the intervention (16). Therefore, considering the limited evidence in this field, this study investigates the effect of multimedia training on fear of falling, home safety, and quality of life in older adults in Shiraz, Southern Iran. The multimedia intervention utilized in this study was developed based on adult education principles (19). The study hypothesized that the mean scores of the fear of falling, home safety, and quality of life were significantly different in both groups before and after the intervention.

2. Objectives

The objectives of this study were set as follows:

(1) To determine the mean scores of the fear of falling, home safety, and quality of life in both groups.

(2) To compare the mean scores of the fear of falling, home safety, and quality of life in both groups before and after the intervention.

3. Methods

3.1. Ethical Considerations

All eligible older adults (above 60 years old) who submitted written informed consent were included in the study. The ethics committee of Shiraz University of Medical Sciences approved the study protocol registered as IR.SUMS.REC.1394.s667, and IRCT number IRCT2016011626036N1.

3.2. Study Setting, Design, and Subjects

This was a randomized, parallel, double-blind trial with two groups. The eligible participants were recruited from the outpatient orthopedic clinic of Dena Hospital in Shiraz, Iran. The study was conducted from December 2017 to December 2018.

According to the WHO definition, 102 older adults over 60 were consecutively recruited over five months from July to November 2017. Eventually, 100 subjects were enrolled as the study participants. They were then randomly allocated to the control and intervention groups with blocked randomization. G-power software was utilized to determine the sample size, considering the fear of falling variable in the study conducted by Najafi et al. (20) with an alpha value of 0.05 and test power of 0.80. The calculated sample size was 42 per group, which was later increased to 50.

3.3. Eligibility Criteria

The inclusion criteria for this study were: Being an older adult, having visited the selected orthopedic clinic with the complaint of falling in the last year or being exposed to the risk of falling, having high or average physical ability based on the Persian version of Katz activities of daily living index (21, 22), and average or high cognitive ability based on the mini-mental state examination (23).

3.3.1. Exclusion Criteria

The exclusion criteria were: A previous diagnosis of a mental disorder or use of medications for mental disorders, unwillingness to participate, death during the study, having attended the training sessions more than once, and having participated in similar studies.

3.4. Randomization, Concealment, and Blinding

A total of 100 qualified older adults were randomly assigned to the intervention (multimedia training) and control (standard teaching) groups using permuted randomization with a block size of four generated by the random sequence generator software by the research advisor.

To conceal randomization, 100 envelopes were numbered and given to the research assistant at the reception desk of the orthopedic clinic. Each envelope was opened at the time of the patient's visit and was used to assign the subject to pre-defined groups. The subjects received their personalized educational content separately. All older adults in both groups were completely blinded to the group allocations, including the researcher assistant, who divided the participants into groups based on the envelope numbers, and the researchers who filled out the questionnaires. However, the caregivers who provided training to the intervention group were not blinded.

3.5. Intervention

3.5.1. Instructional Design

The instructional design of this multimedia intervention was based on the model used in a virtual school, namely the Comprehensive Center of Excellence for E-Learning in Medical Sciences, Shiraz University of Medical Sciences. The e-content was developed using Adobe Flash in pre-designed formats based on the standards of the virtual school. The produced content was evaluated, edited, and modified as alpha and beta versions until the gold version was approved. The content was then verified and recorded on a DVD (24).

3.5.2. Study Intervention

After selecting the samples and dividing them into the control and intervention groups, they were briefed on the research objectives and asked to complete the questionnaires. Subsequently, a session was held for the patients and their caregivers, and their home environment was scanned regarding the risk of falling using specific tools. After completing the questionnaires, a training session was held at the hospital for the older adult and caregiver pairs in the intervention group that lasted 40 to 60 minutes. Multimedia content provided by DVDs was used to teach the subjects how to improve their living environment for older age groups, and environmental modifications were recommended to the patients and their caregivers with an emphasis on cost-effectiveness. This DVD was designed to educate on the risk factors of falls in older adults.

At the end of the sessions, the participants were allowed to ask questions. During this session, the caregivers talked about monitoring the older adult's home and investigating potential options for environmental change. The researchers scheduled an appointment to visit each subject's home and evaluate it regarding environmental risks. During this visit, the researchers gave the necessary recommendations and warnings concerning each family's financial means. They also instructed the older adults and their caregivers not to alter home improvements throughout the intervention (i.e., from the pretest to the posttest). A copy of the instructional DVD was given to each family in the intervention group, and they were asked to use it at home or call the researcher at designated hours to ask questions if needed. Three months after the intervention, during a pre-scheduled home visit, the questionnaires were completed again in both groups by asking questions from the older adults and their caregivers. The control group received their usual required medical and nursing care and rehabilitation. They were also referred to outpatient services if needed. After the end of the intervention, the instructional DVD was also given to the control group, and their questions were answered.

3.6. Outcomes

3.6.1. Primary Outcome

The primary outcome of this study was the effect of multimedia training about fall prevention on the fear of falling in older adults above 60.

3.6.2. Secondary Outcomes

The secondary outcomes of the study were the effect of multimedia training on fall prevention on home safety and quality of life in older adults above 60.

3.7. Instruments and Data Collection

The data collection instruments used in this study included:

(1) Demographic Information Questionnaire: This questionnaire inquired about the respondents' gender, employment status, education, marital status, and frequency of falling over the last year and the types of

accidents and their probable causes in one of the 6 main areas of their homes.

(2) Falls Efficacy Scale-International: The Falls Efficacy Scale-International (FES-I) is a short and easy tool that measures the fear and concern in older adults about falling during 16 different social and physical activities performed inside and outside the home environment. This tool is designed by the prevention of falls network Europe (ProFaNE). In this 16-item scale, items 1 - 10 are considered the main fall efficacy items, and the next six deal with walking on slippery surfaces, visiting friends or relatives, walking in crowds, walking on uneven surfaces, walking up or down slopes, and participating in social events. Each item measures the respondent's fear of falling while performing an activity based on a 4-point scale (from 0 = 'not concerned at all' to 3 = 'very concerned'). The scores range from 0 to 48, and higher scores indicate a greater fear of falling. After the development of the initial FES-I, its validity, and reliability were examined; the results showed that the scale had excellent internal validity (Cronbach's alpha = 0.96). The test-retest reliability of the tool was also appropriate (ICC = 0.96) (25).

In Iran, Baharlouei et al. assessed the psychometric validity of this scale's Persian version, reported its acceptable reliability and validity, and concluded that the scale was suitable for use among older Iranian adults. To evaluate the construct validity of the tool, they assessed the ability of the FES-I to discriminate against people based on gender, education, frequency of falls, and fear of falling. The correlation of the scale with the short form of health survey (SF-36), timed up and go (TUG), and Functional Reach Test (FRT) was also determined to test the tool's validity. The internal consistency of the tool was excellent in both self-report (0.93) and interview (0.92) versions (26).

(3) The home falls and accidents screening tool: This instrument is developed in Australia to assess falling and home safety. It is especially suitable for evaluating older adults living at home. The home falls and accidents screening tool (HOME FAST) contains 25 items that inquire about a wide range of functional safety concerns at home and in the domestic environment, and they are answered with three options, 'yes,' 'no,' and 'not applicable.' The scores obtained range from 25 to 75. The original scale demonstrated excellent psychometric properties (27). In Iran, the validity and reliability of the instrument were measured, and its reliability was reported as 0.88 (28).

(4) LEIPAD Elderly Quality of Life Questionnaire: This questionnaire was developed by De Leo et al. It can be easily used as an international instrument for all age groups in different societies. This questionnaire measures older adults' quality of life with a greater sensitivity than other instruments. It contains 31 items in seven dimensions: Physical performance (five items), self-care (six items), depression and anxiety (four items), mental performance (five items), social performance (three items), sexual performance (two items) and life satisfaction (six items). The items are scored based on a 4-point Likert scale from 0 to 3 (0 = 'weak,' 1 = 'average,' 2 = 'good,' and 3 = 'very good'). The total score ranges from 0 to 93 (29). Ghasemi et al. examined the validity and reliability of this questionnaire among older Iranian adults and reported its Cronbach's alpha reliability coefficient as 0.831 (30).

3.8. Statistical Analysis

Before the statistical analysis, we checked, cleaned, and screened the study data. We checked all missing values in all dependent and independent variables and revised them according to the participants' records. Ultimately, missing values in main variables were < 5% and no further action was required.

Data were analyzed by SPSS-21 using descriptive (mean, standard deviation, frequency, and percentage) and inferential (chi-square test, and the independent sample *t*-test and paired *t*-test) statistics in both control and intervention arms before and after the intervention. The standardized mean difference (Cohen's d) was also measured to calculate the strength of the relationship (effect size) between the intervention and the outcomes. The level of statistical significance was set at $P < 0.05$.

4. Results

4.1. Participants' Characteristics

A total of 102 patients were enrolled in this trial, and two of them dropped out. Figure 1 presents the flow diagram of the study, and Table 1 tabulates the demographic characteristics of the participants. The mean age of the participants was 68.7 years (63% male). The mean and standard deviation of age were 68.5 ± 7.40 in the intervention and 68.82 ± 4.73 in the control groups. Among the intervention and control group participants, 36 (72%) and 27 (54%) were male, respectively. There were no significant differences between the two groups regarding basic characteristics such as age (P = 0.8), gender (P = 0.53), marital status (P = 0.36), education (P = 0.2), employment status (P = 0.13), house occupancy status (P = 0.08), and number of children (P = 0.18).

The mean scores of the intervention and control groups in the primary outcome (fear of falling) and secondary outcomes (home safety and quality of life) were compared at the pre-and post-intervention stages. Table 2 compares the two groups' mean scores in the three

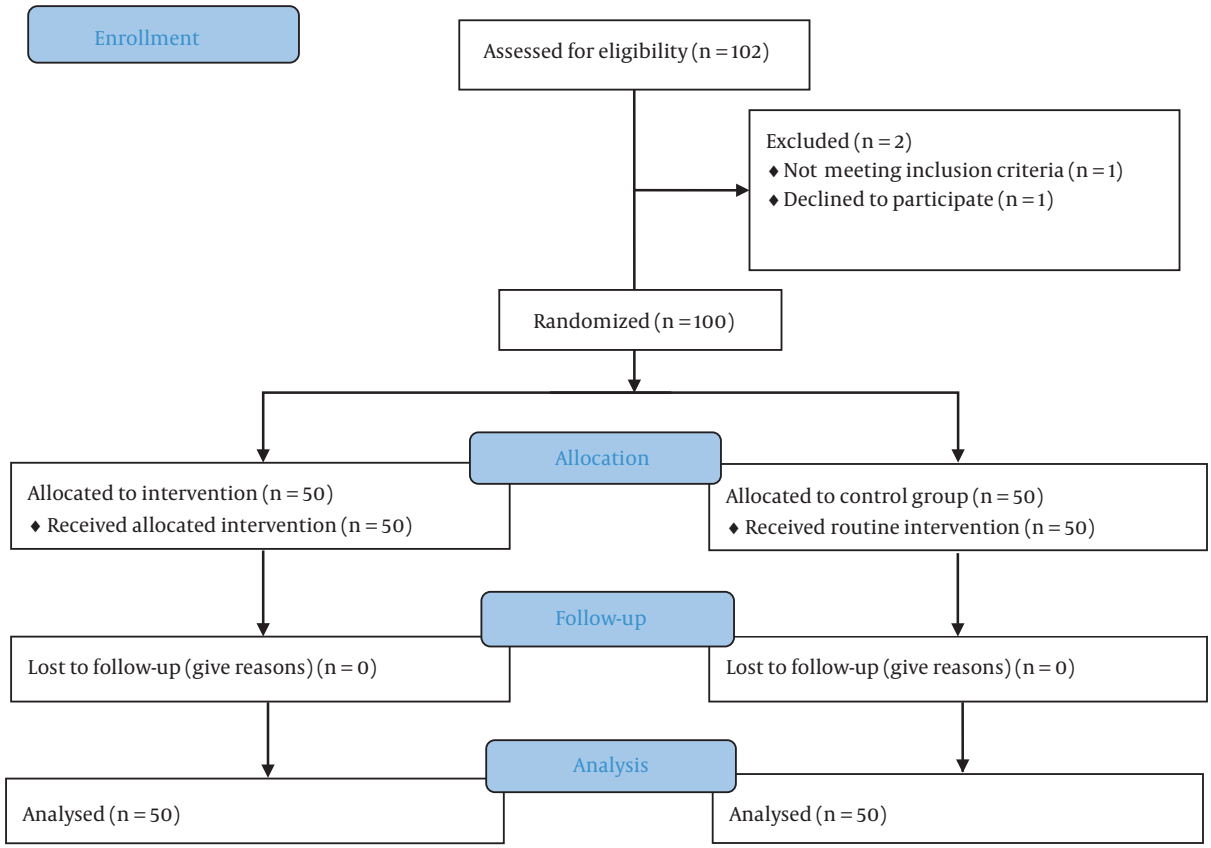

Figure 1. Flow diagram of the study participants in each stage of the study

outcomes under study, namely fear of falling, home safety, and quality of life, before and after the intervention.

According to the results of this table, a significant difference was observed in the mean scores before and after the intervention in terms of home safety ($P < 0.001$) in the intervention group. Still, there were no significant differences between the pre-and post-intervention scores of the fear of falling ($P = 0.30$) and quality of life ($P = 0.32$). In the control group, there were no statistically significant differences in the mean scores of the three investigated outcomes.

Standardized mean differences (Cohen's d) were also used to measure the strength of the relationships or effect sizes. They were reported as 0.21 (95% CI: -0.18 - 0.6) for fear of falling, 0.84 (95% CI: 0.43 - 1.3) for home safety, and 0.20 (95% CI: -0.19 - 0.59) for the quality of life ($d = 0.2$ was considered a 'small' effect size, 0.5 a 'medium,' and 0.8 a 'large' effect size).

According to the results, the intervention was effective ($d = 0.84$; 95% CI: 0.43 - 1.3) in increasing "home safety" in the participants in the intervention group. In other words, with a Cohen's d of 0.8, about 80% of the mean score in home safety was higher in the intervention group than in the control group.

5. Discussion

Falling is the most commonly reported problem associated with aging, and informing people about its ramifications and prevention can have positive effects. Multimedia training alongside regular care for patients with a history of falling can improve their understanding of the issue. After receiving multimedia training on these concepts, this randomized controlled trial assessed fear of falling, home safety, and quality of life in older adults.

This study showed that multimedia training had no significant effect on the fear of falling. This finding was inconsistent with the quasi-experimental study by Najafi et al., which investigated the impact of educating residents about controlling risk factors of falling and video

Table 1. The Characteristics of the Study Population [a]

Variables	Intervention Group (n = 50)	Control Group (n = 50)	P-Value
Sex			0.53 [b]
Male	36 (72)	27 (54)	
Female	14 (28)	23 (46)	
Marital status			0.36 [b]
Single	0 (0)	0 (0)	
Married	37 (74)	44 (88)	
Divorced	0 (0)	0 (0)	
Widowed	13 (26)	6 (12)	
Education			0.20 [b]
Just literate	12 (24)	8 (16)	
Elementary school	15 (30)	18 (36)	
Junior high school	5 (10)	0 (0)	
High school	18 (36)	24 (48)	
Higher education	0 (0)	0 (0)	
Employment status			0.13 [b]
Laborer	0 (0)	0 (0)	
Employed in corporations	1 (2)	0 (0)	
Housewife	21 (42)	26 (52)	
Retired	19 (38)	15 (30)	
Other	9 (18)	9 (18)	
House occupancy status			0.08 [b]
Owner	50 (100)	43 (86)	
Renting	0 (0)	7 (14)	
Organizational	0 (0)	0 (0)	
Age	68.50 ± 7.40	68.82 ± 4.73	0.80 [c]
Number of children	4.24 ± 2.29	3.66 ± 2.18	0.18 [c]

[a] Values are expressed as No. (%) or mean ± SD.
[b] Chi-square test.
[c] Two independent sample *t*-test.

exercise training on the fear of falling in nursing homes and found that this method could be an inexpensive and easy-to-implement approach for reducing fear of falling (20). In another randomized trial, the effects of education and activity programs for eight weeks on the fear of falling were examined in community-dwelling seniors, and reduced fear of falling was reported in both groups (31). A plausible explanation for this discrepancy is that fear is a psychological concept that may change gradually over time. Nonetheless, the current investigation did not incorporate any long-term follow-up assessment. Additionally, the study design and educational materials utilized were dissimilar, which could have influenced the outcomes. Future studies should be conducted to more comprehensively evaluate the impact of multimedia programs on fall prevention, along with periodic follow-up evaluations on fear of falling in this age group.

In the present study, home safety improved significantly in the intervention group compared to the control group. This finding is consistent with the results of a previous study by Peel et al. that reported that multi-component fall prevention interventions, which encompassed education, exercise, home modification, and medical assessments, resulted in a minimum of one modification to the home environment for 59% of subjects compared to 32% of controls (32). In another study, a multimedia-based fall prevention education promoted fall prevention behaviors in older adults (16). Aging decreases the physical and cognitive abilities of individuals. Therefore, home design should be tailored to accommodate aging individuals' needs and limitations to minimize barriers and maximize their participation in daily activities. Home assessment and modifications, which were considered in the present intervention, can have a fundamental role in preventing falls and fall-related injuries in older adults (33). Improving home safety requires teamwork with the entire family. Although factors such as the family's economic status, behavioral aspects, and living environment can affect home safety, some change is always possible.

In this study, no significant differences were observed between the intervention and control groups regarding the total scores of the quality of life following the intervention. This finding is consistent with a previous study on older adults which reported that an information-oriented intervention comprising a counseling session, a video, and a booklet did not affect fall prevention, fear of falling, social functioning, or quality of life compared to the control group (34). Similarly, another trial found no benefit of a video-based exercise program on falls and health-related quality of life among older adults discharged from the hospital (35). Nonetheless, Lin et al. conducted a study to evaluate the impact of fall-prevention programs, including education through social visits and pamphlets, home safety assessment and modification, and exercise training in older individuals who had recently experienced a fall. Their findings demonstrated that exercise training was more effective than the other two interventions in improving the quality of life. Education alone improved only one domain (physical) out of four domains (physical, psychological, social, environmental) of quality of life in this population (36). One possible explanation for these disparities can be the differences in the education route and its contents. Another possible

Table 2. Comparing the Mean Scores and SDs of Fear of Falling (Primary Outcome) and Home Safety and the Quality of Life (Secondary Outcomes) Before and After the Intervention in the Two Groups

Outcomes and Time	Intervention Group			Control Group		
	Mean ± SD	P-Value [a]	Effect size (95% CI) [b]	Mean ± SD	P-Value	Effect Size (95% CI) [b]
Fear of falling		0.30	-		0.87	-
Pre-intervention	36.21 ± 8.85			38.32 ± 7.48		
Post-intervention	37.93 ± 7.75			38.08 ± 7.18		
Home safety		< 0.001	0.84 (0.43 - 1.3)		0.49	-
Pre-intervention	33.55 ± 6.50			44.24 ± 3.57		
Post-intervention	40.37 ± 4.88			44.70 ± 3.08		
Quality of life		0.32	-		0.83	-
Pre-intervention	65.6 ± 10.09			67.76 ± 9.27		
Post-intervention	67.54 ± 9.30			68.18 ± 9.25		

[a] Paired *t*-test
[b] Cohen's d (d = 0.2 considered a 'small' effect size, 0.5 'medium' and 0.8 'large' effect size).

explanation is that, in the present study, participants still had some fear of falling during the post-test period and had not fully resumed their normal daily activities.

To assess the effect of the intervention, the effect size was separately calculated for each variable or outcome examined, i.e., fear of falling, home safety, and quality of life. Cohen's d showed that the intervention had a small effect on fear of falling and quality of life but a large effect (four times higher) on home safety.

The strengths of this study include using valid and reliable tools to measure the variables, developing the instructional content based on e-learning standards, randomly assigning the participants to the study groups to ensure homogeneous distribution of any confounding factor and the absence of attrition bias due to retaining all participants until the end of the study. To control selection bias, age, sex, marital status, education level, occupation, and income were examined during the allocation phase. The distribution of these variables was not significantly different between the two study groups.

Our study had several limitations, such as generalizability to all older adults due to potential differences in health conditions and injuries among this age group and cultural diversity. Additionally, a longer follow-up period could be more beneficial for the patients to apply their newly acquired skills in daily life. Furthermore, the small statistical population of the study may have reduced its efficiency and led to biased results, highlighting the need for a larger sample size in future studies. Besides, although the participants and investigators were unaware of the intervention type, service providers could not be blinded, which may have exaggerated the effect of the intervention. To minimize attrition bias, the researchers implemented a regular visit plan and followed-up participants via telephone and in-person visits, resulting in zero loss to follow-up cases.

5.1. Conclusions

Providing multimedia training to older adults to promote their self-care should have more practical aspects that engage the trainees in actual activities. The model used in the present study can be applied in nursing research for better evaluation of elderly care services.

Footnotes

Authors' Contribution: Study concept and design: Gholamzadeh and Mehrabi; acquisition of data: Gholamzadeh and Rezaei; analysis and interpretation of data: Gholamzadeh, Safarpour and Mehrabi; drafting of the manuscript: Gholamzadeh, Safarpour, Mehrabi and Rezaei; critical revision of the manuscript for important intellectual content: Gholamzadeh, Mehrabi and Safrpour; statistical analysis: Safrpour and Gholamzadeh; administrative, technical, and material support: Gholamzadeh, Mehrabi and Safarpour; study supervision: Gholamzadeh.

Clinical Trial Registration Code: IRCT2016011626036N1.

Conflict of Interests: The authors have no conflicts of interest to declare.

Data Reproducibility: The dataset presented in the study is available on request from the corresponding author during submission or after publication. The data are not publicly available.

Ethical Approval: The study protocol was approved by the ethics committee of Shiraz University of Medical Sciences under the ethics code IR.SUMS.REC.1394.s667.

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Informed Consent: All the eligible older adults (above 60 years old) who submitted written informed consent were enrolled in the study.

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