

# The Effect of Sensory Stimulation on Quality of Life of the Elderly and their Self-efficacy for Coping with the Fear of Falling

## Abstract

**Background:** Aging causes major changes that affect the performance of all senses, and as a result, a critical change in the quality of life is expected. Falling and the fear of falling is one of the major health risks that affect the quality of life among elderly, threatening their independent living. This study was conducted to determine the role of sensory stimulation on the quality of life and self-efficacy in coping with fear in the elderly population. **Materials and Methods:** During this randomized controlled trial, 80 elderly volunteers from healthcare centers were divided into four intervention groups (music, photo album, aromatherapy, and hand massage) and one control group. Data collection was performed using the Older People's Quality of Life Questionnaire and Falls Efficacy Scale-International tools. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software program, version 16.0. **Results:** Comparing the scores of the quality of life and self-efficacy questionnaires, no statistically significant difference was reported among the groups ( $p < 0.05$ ). **Conclusions:** Sensory stimulation seems to have no impressive effect on the improvement of self-efficacy in coping with the fear of falling and the quality of life in the older population.

**Keywords:** Aging, physical stimulation, quality of life, self efficacy

## Introduction

The older population is experiencing a dramatic increase in most developing countries, currently including more than 800 million individuals.<sup>[1]</sup> It is estimated to reach 1 billion by 2020 and approximately 2 billion by 2050.<sup>[2,3]</sup> Senility is a sensitive period of human life, as it mainly results in weakness of physical and psychosocial abilities.<sup>[4]</sup> These changes also impact the individual's interactions with environmental drivers. Furthermore, aging influences the function of all human senses, including vision, olfactory, and hearing. Unlike the past, the increase in life expectancy has led the main challenge of the present century to "living a better life."<sup>[5-7]</sup> Studies have shown that the Quality of Life (QoL) drops in the people aged 60 years and over as a result of decreased physical activity and dependency.<sup>[8]</sup> Numerous interventions have been taken into account to improve the QoL in the older population, for example, shreds of evidence are suggesting that the multisensory stimulation improves the QoL in patients with dementia.<sup>[9,10]</sup>

One of the problems affecting the QoL is the fear of falling. Repetitive falling episodes can also impair the QoL of older people by reducing their mobility and dependency.<sup>[11]</sup> Older people are prone to fall, and one out of three of them experience falling at least once a year.<sup>[12]</sup> The fall is the first cause of death and the third cause of poor health in the elderly population.<sup>[13]</sup> It is considered as a major public health issue, mainly leading to poor QoL and serious physical and emotional outcomes.<sup>[14]</sup> Falling is mostly experienced in the yards and bathrooms, and it is three-time more probable to occur in women in comparison with men. However, the mortality rate is higher in men and is directly related to age.<sup>[15,16]</sup> The prevalence of fear of falling is reported to be between 21% and 85%.<sup>[14]</sup> The falling risk depends on many factors, such as the ability to maintain balance. Hence, it is not out of mind that age-related muscle weaknesses result in an imbalance and consequently, an increase in the number of falls.<sup>[8,17]</sup>

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Although different methods of complementary therapy, such as aromatherapy, massage and touch therapy, and sensory stimulation are suggested to deal with the fear of falling and improve the QoL, no previous study has discussed the role of sensory stimulation in shifting the quality life and affecting the fear of falling in the elderly population.<sup>[10,11]</sup> Sometimes the fear of falling and information about it can be a valuable component of nursing education, especially for nurses working in the field of the elderly. Nurses are ideally positioned to use sensory stimulation because of their greater contact with the elderly, the noninvasive nature of sensory techniques, and their effective training and caregiving.<sup>[18,19]</sup> Due to the cultural considerations of Iran and the precious dignity of the elderly, and the lack of proper studies to compare the mentioned interventions, this study was conducted to determine the effect of sensory stimulation on coping with the fear of falling, and quality life in the older population.

## Materials and Methods

During this randomized controlled trial (IRCT201707026918N26), conducted in August and September 2018, 80 volunteers with the inclusion criteria of being over 60, awareness of time and place, no hearing, olfactory, and visual impairment, no orthopedic, rheumatologic and neurological disorders leading to pain, who actively participated in the healthcare centers' activities (e.g., exercise, cooking, painting) were recruited. Lack of allergy to almond oil and lavender was also mentioned among inclusion criteria. The exclusion criterion was the absence for more than three times during the study and hospitalization. The hearing tests (Weber test and whisper) were conducted by the researcher. The ability to distinguish the smell of alcohol and water was also considered. Having a visual acuity of more than 0.6 was checked based on the medical records of the individuals. To determine the proper sample size, a pilot study with three individuals in each group was conducted. The sample size was calculated for each of the nine subheadings of the "Older People's Quality of Life Questionnaire-35". Considering the power of 80%,  $\alpha = 0.05$  and the difference of 0.7 in the Home and Neighborhood subheading—the variable with the highest sample size—the total sample size was calculated, and 14 individuals were estimated for each intervention group. To increase the study validation, 16 individuals for each group (a total of 64 individuals) were gathered using the simple random method [Figure 1]. They were assigned into five equal groups ( $n = 16$  in each group) by the randomized block method. The table of random numbers was used to generate random numbers. To avoid allocation concealment in the random assignment of the subjects to the groups, opaque and sealed envelopes were used. Five types of envelopes were available, including the audition, visual, olfactory, touch stimuli, and the control, and each subject would be randomly assigned to one of these groups.

The code was sealed by an independent monitor and was not broken until the statistical analysis was finalized. The intervention phase was conducted for 4 weeks, 3 sessions per week, and 10 min in each time. During the intervention phase of the study, one person from the aromatherapy group and one person from the massage group abandoned the study due to the feeling of nausea and wrist injury, respectively [Figure 1].

Older People's Quality of Life (OPQOL)-35 validated by Nikkha *et al.*,<sup>[20]</sup> consisting of 35 statements with the participant being asked to indicate the extent to which he/she agrees, with every single statement by choosing one of five possible options among "strongly disagree," "disagree," "neither agree nor disagree," "agree" and "strongly agree." Each of the five possible answers is given a score of 1–5, where higher scores indicate a better QOL. Thus, the total score ranges from 35 (the worst possible QOL) to 175 (the best possible QOL). The 35 statements of the questionnaire consider the following aspects of QOL: life overall, health (score range 4–20), social relationships and participation, independence, control over life and freedom, home and neighborhood, psychological and emotional well-being, financial circumstances, leisure, activities, and religion.<sup>[20,21]</sup> Falls Efficacy Scale (FES)-I is a short, easy to administer tool that measures the level of concern about falling during social and physical activities inside and outside the home whether or not the person actually does the activity. The level of concern is measured on a 4-point Likert scale (1 = not at all concerned to 4 = very concerned. FES-I is validated by Delbaere *et al.*<sup>[22-24]</sup>

The tools were once again appraised by ten experts from Tabriz University of Medical Sciences, and no major modification was made in their contents. In all of the groups, all the procedures were done in 10-min sessions, three sessions per week and for 4 weeks, resulting in 12 sessions of therapy for each individual in the four intervention groups. The sessions were held between 11 am to 1 pm, at an Aging referral health center. In the massage therapy group, the assistant researcher—who had been previously trained for 3 weeks on how to perform a proper massage—started the massage from the right hand with the slow rhythm and lowest pressure. In the following, the massage was continued in the direction of the heart with a slow rhythm and greater pressure for 5 min, and eventually ending to the extremity of the left hand. In the aromatherapy group, a couple of lavender droplets were placed in a glass, and the individuals were instructed to inhale it for 10 min, 1 h before bedtime with a 3–5 cm distance from their nose. During the intervention, the assistant researcher contacted the subjects to remind them to follow the procedure. In the music therapy group, subjects listened to their favorite music tracks, while lying on a chair in a dark room. Disposable headphones were also used to prevent environmental noises. In the photo album group, subjects individually watched 10–15 photos

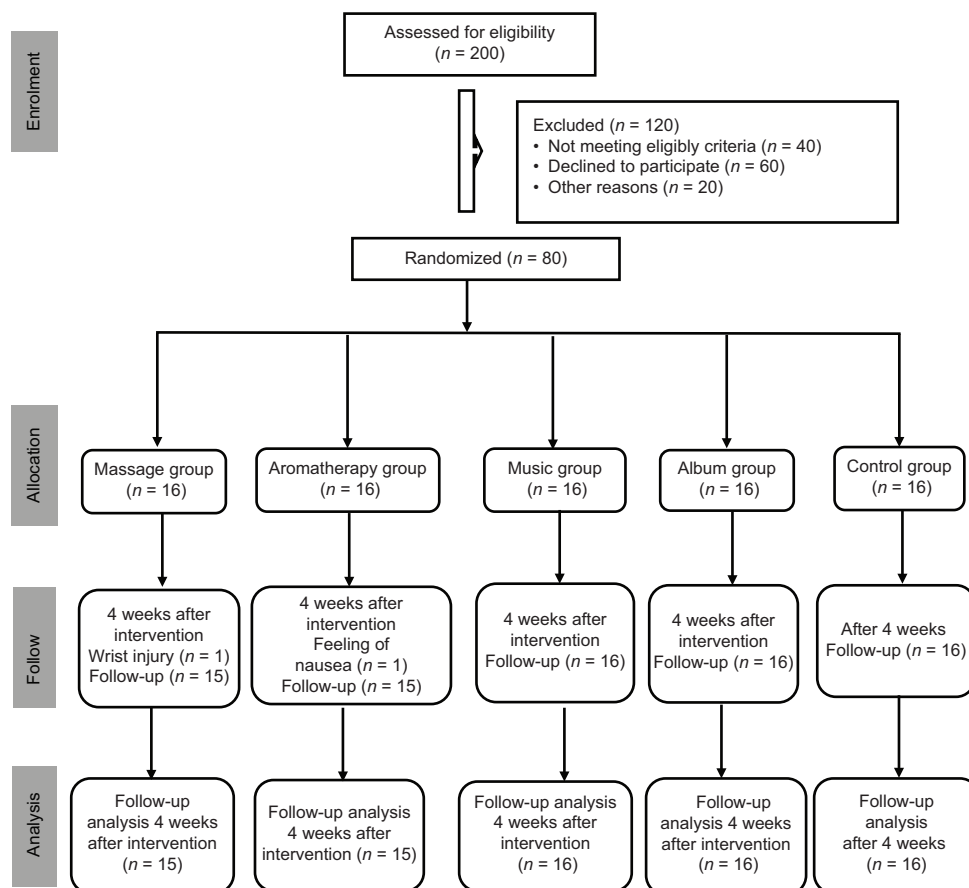


Figure 1: Consort diagram of the study

for 10 min. This intervention was accompanied by memory telling, and at the end of the 12th session, the album was given to them. In the control group, no intervention was performed, and the subjects only were asked to fill out the questionnaires [Figure 1].

To test the normality of data, the Kolmogorov–Smirnov test was used. Descriptive data were reported as mean (standard deviation) and frequency (%). To compare the quantitative variables in the studied groups, one-way analysis of variance (ANOVA) and independent *t*-test were used for qualitative variables. Chi-square test was also used for qualitative variables. An analysis of covariance was used to compare the different dimensions of QoL among the studied groups, taking into account the pre-intervention scores as a covariate. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) software program, version 16.0 (SPSS, Chicago, Illinois) and a value of  $p < 0.05$  was considered statistically significant.

### Ethical considerations

This article was derived from a research project at Tabriz University of Medical Sciences (code: IR.TBZMED.REC.1396.671). All subjects were made aware of the study content, and a written informed consent document was obtained. The information of all patients was anonymous

and they could quit the study on personal desire, regardless of the study stage.

### Results

The mean (SD) age of participants in this study was 67.84 (4.90) years. In addition, 50 (62.50%) of them were retired employees, and 7 (8.75%) were still working, even after retirement. Based on the results, 31 (38.75%) had a low economic status, and 43 (53.75%) had an equal income and expense. It was reported that 34 (42.50%) of the subjects had an academic education, 19 (23.75%) had heart disease and 14 (17.50%) had gastrointestinal disease [Table 1]. No statistically significant differences were reported among the groups in terms of age ( $p = 0.78$ ), education ( $p = 0.06$ ), and economic status ( $p = 0.20$ ). Table 2 indicates the subjects' QoL before and after the study in the five groups. Also, the mean and standard deviation of the individuals' self-efficacy score in coping with the fear before and after intervention are summarized in Figure 2. Comparison of changes in the QoL scores and self-efficacy in coping with fall before and after the intervention showed no significant differences in the changes of the components and the total score ( $p > 0.05$ ). Also, the Wilcoxon test showed no statistically significant difference between the scores of the total QoL and self-efficacy in coping with fall before and

**Table 1: Demographic information**

Variables		Massage (n=16)	Aromatherapy (n=16)	Music (n=16)	Photo Album (n=16)	Control Group (n=16)	<i>p</i>
Age (mean [SD])		67.31 [1.67]	66.75 [2.95]	68.81 [5.31]	67.94 [5.01]	68.38 [4.14]	0.78
Gender	Male	7 (43.75%)	4 (25.00%)	11 (68.75%)	7 (43.75%)	8 (50.00%)	0.17
	Female	9 (56.25%)	12 (75.00%)	5 (31.25%)	9 (56.25%)	8 (50.00%)	
Children	0	2 (2.50%)	2 (2.50%)	1 (1.25%)	0 (0.00%)	0 (0.00%)	0.82
	1	2 (2.50%)	0 (0.00%)	0 (0.00%)	1 (1.25%)	0 (0.00%)	
	2	3 (3.75%)	4 (5.00%)	8 (10.00%)	6 (7.50%)	6 (7.50%)	
	3	4 (5.00%)	4 (5.00%)	3 (3.75%)	7 (8.75%)	6 (7.50%)	
	4	2 (2.50%)	1 (1.25%)	3 (3.75%)	2 (2.50%)	3 (3.75%)	
	5	3 (3.75%)	5 (6.25%)	1 (1.25%)	0 (0.00%)	1 (1.25%)	
Educational level	Primary	6 (7.50%)	7 (8.75%)	0 (0.00%)	2 (2.50%)	1 (1.25%)	0.25
	Under diploma	1 (1.25%)	0 (0.00%)	1 (1.25%)	4 (5.00%)	2 (2.50%)	
	Diploma	2 (2.50%)	7 (8.75%)	5 (6.25%)	4 (5.00%)	4 (5.00%)	
	Bachelor degree or higher education	7 (8.75%)	2 (2.50%)	10 (12.50%)	6 (7.50%)	9 (11.25%)	
Living alone	Yes	0 (0.00%)	2 (2.50%)	0 (0.00%)	0 (0.00%)	1 (1.25%)	0.50
	No	16 (20.00%)	14 (17.50%)	16 (20.00%)	16 (20.00%)	15 (18.75%)	
Life status	With wife	13 (16.88%)	11 (14.29%)	15 (19.48%)	12 (15.58%)	13 (16.88%)	0.05
	Single	3 (3.90%)	5 (3.90%)	1 (1.30%)	4 (5.19%)	3 (2.60%)	
Job	Retired	8 (15.38%)	9 (17.31%)	13 (25.00%)	9 (17.31%)	11 (21.15%)	0.88
	Self-employed	0 (0.00%)	0 (0.00%)	1 (1.92%)	1 (1.92%)	0 (0.00%)	
Working after retirement	Yes	2 (3.85%)	1 (1.92%)	1 (1.92%)	3 (5.77%)	0 (0.00%)	0.24
	No	6 (11.54%)	8 (15.38%)	13 (25.00%)	7 (13.46%)	11 (21.15%)	
Economic status	Equal to the cost	7 (8.75%)	11 (13.75%)	5 (6.25%)	12 (15.00%)	8 (10.00%)	0.20
	More than spending	1 (1.25%)	0 (0.00%)	3 (3.75%)	1 (1.25%)	1 (1.25%)	
	Less than spending	8 (10.00%)	5 (6.25%)	8 (10.00%)	3 (3.75%)	7 (8.75%)	
Property status	Private	16 (20.00%)	14 (17.50%)	16 (20.00%)	14 (17.50%)	12 (15.00%)	0.09
	Leased	0 (0.00%)	2 (2.50%)	0 (0.00%)	2 (2.50%)	4 (5.00%)	
History of disease	Cardiovascular	3 (7.32%)	1 (2.44%)	4 (9.76%)	4 (9.76%)	3 (7.32%)	0.72
	Endocrine	1 (2.44%)	4 (9.76%)	1 (2.44%)	2 (4.88%)	3 (7.32%)	
	Cardio and endocrine	1 (2.44%)	1 (2.44%)	1 (2.44%)	2 (4.88%)	4 (9.76%)	
	Musculoskeletal	2 (4.88%)	3 (7.32%)	1 (2.44%)	0 (0.00%)	0 (0.00%)	
Drugs	Cardiovascular	3 (7.14%)	1 (2.38%)	4 (9.52%)	4 (9.52%)	4 (9.52%)	0.86
	Endocrine	2 (4.76%)	4 (9.52%)	1 (2.38%)	3 (7.14%)	3 (7.14%)	
	Cardio and endocrine	1 (2.38%)	1 (2.38%)	2 (4.76%)	2 (4.76%)	3 (7.14%)	
	Musculoskeletal	2 (4.76%)	1 (2.38%)	1 (2.38%)	0 (0.00%)	0 (0.00%)	

after the intervention between the intervention and control groups ( $p > 0.05$ ).

In response to an open-ended question in the intervention group, the elderly mostly preferred to continue the massage, because numbness and pain in fingers and wrists were reduced during the massage sessions. On the other hand, they sensed the softness of their fingers and felt more comfortable with their hands. The individuals from the aromatherapy group declared they had remarkably fewer nightmares and were more comfortable with sleeping. The music group also stated that they had experienced less anxiety and were far from their previously common worries. In the photo album group, individuals recalled good memories of missed ones through viewing photos.

## Discussion

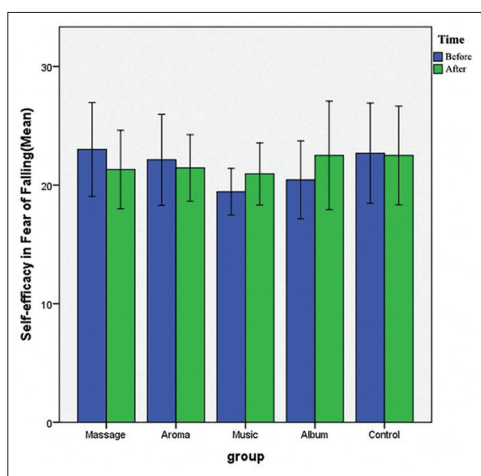
This study was performed on 80 elderly adults referred to a healthcare center to investigate the effect of sensory

stimulation on the QoL and self-efficacy in coping with the fear of falling. Most participants were women, employees, and highly educated. Organizational sensory stimulation did not affect the QoL and self-efficacy of the fear of falling. Previous studies had shown a significant association between the fear of falling and the education level, which was consistent with the result of this study.<sup>[25,26]</sup> According to these studies, educated elderly subjects had a small number of previous falls. Therefore, the score of the fear of falling was low, but the interventions failed to show significant differences. On the side of hearing stimulation, this study showed no significant impact on the QoL and self-efficacy of the fear of falling. In contrast with these results, a previously conducted randomized placebo-controlled trial showed that live music played an effective role in sensory stimulation compared to nonlive music or silence.<sup>[27]</sup> This discrepancy may be related to the types of music (live music vs. nonlive music).



**Table 2: The subjects' quality of life mean (SD) scores before and after the study**

Dimensions/group		Massage	Aroma	Music	Album	Control	<i>p</i>
Life overall	Before	13.63 (1.54)	13.69 (1.66)	13.31 (1.58)	14.38 (1.2)	13.69 (2.57)	0.69
	After	13.75 (1.13)	14.25 (1.34)	13.88 (1.63)	13.56 (2.85)	13.69 (2.57)	
	<i>p</i>	0.79	0.17	0.30	0.39	–	
Health	Before	12.88 (2.39)	13.63 (2.33)	13.06 (2.54)	14.38 (2.09)	13.63 (2.09)	0.73
	After	13.75 (1.88)	14.38 (2.36)	13.38 (2.31)	14.69 (2.85)	13.63 (2.09)	
	<i>p</i>	0.05	0.32	0.45	0.69	–	
Social relationships	Before	9.5 (2.16)	9.25 (1.88)	10.06 (2.59)	9.75 (1.44)	10.25 (2.05)	0.43
	After	8.88 (2.13)	9.13 (1.09)	9.5 (1.79)	9.63 (2.09)	10.25 (2.05)	
	<i>p</i>	0.28	0.72	0.36	0.83	–	
Independence, control over life, freedom	Before	12.81 (1.83)	13.56 (2.25)	12.69 (1.66)	12.94 (1.18)	12.81 (2.14)	0.90
	After	13.25 (1.81)	13.19 (1.38)	12.94 (1.65)	12.88 (1.63)	12.81 (2.14)	
	<i>p</i>	0.48	0.56	0.54	0.80	–	
Home and neighborhood	Before	13.06 (2.11)	13.19 (1.56)	12.06 (1.65)	12.5 (2.07)	12.25 (1.69)	0.14
	After	13.13 (1.63)	13.5 (2.22)	13.25 (1.57)	12.81 (2.34)	12.25 (1.69)	
	<i>p</i>	0.52	0.26	0.27	0.65	–	
Psychological and emotional well-being	Before	11.19 (1.22)	11 (1.9)	11.94 (1.29)	12.13 (1.31)	11.81 (1.28)	0.97
	After	11.69 (0.6)	11.63 (1.15)	11.75 (1.48)	11.94 (1.06)	11.81 (1.28)	
	<i>p</i>	0.15	0.26	0.53	0.53	–	
Financial circumstances	Before	13.06 (2.11)	13.19 (1.56)	12.06 (1.65)	12.5 (2.07)	12.25 (1.69)	0.36
	After	13.25 (1.81)	13.19 (1.38)	12.94 (1.65)	12.88 (1.63)	12.81 (2.14)	
	<i>p</i>	0.86	0.46	0.02	0.62	–	
Leisure and activities	Before	13.06 (1.88)	14.06 (2.52)	13.13 (2)	14.13 (1.86)	13.25 (1.98)	0.93
	After	13.38 (1.75)	14.06 (2.21)	13.63 (1.63)	14 (1.97)	13.25 (1.98)	
	<i>p</i>	0.31	1.00	0.42	0.74	–	
Religion	Before	2.75 (1.06)	2.5 (0.89)	4.5 (2.68)	3.88 (1.78)	3.75 (1.73)	0.86
	After	3.06 (1.18)	2.75 (1.06)	4 (1.59)	3.88 (2.33)	3.75 (1.73)	
	<i>p</i>	0.09	0.10	0.30	1.00	–	

**Figure 2: Self-efficacy in coping with the fear before and after the intervention**

QoL of men with mental disorders showed that multisensory stimuli improved their QoL in all aspects, which was in contrast with the results of this study.<sup>[28]</sup> The probable reason could be that simultaneous multistimulation were used in their study, but in this study, stimuli were performed individually. In addition, mental disorders were not the main point of interest in this study. Sensory stimulation didn't affect the self-efficacy of the fear of falling in the

elderly. Some studies suggest that noninvasive brain stimulation improves balance in older people suffering from a neurological disease.<sup>[29]</sup> As none of the older people in this study had any neurological problem, the contrast of results is explainable. According to a previously conducted review study, people with a high QoL did not mention the fear of falling, which was consistent with the results of this study.<sup>[30]</sup> In this study, most individuals had an academic education and a high QoL. The fall can disrupt the QoL of the older population by reducing their mobility and independence.<sup>[31]</sup> A significant difference between the mean of QoL in normal people and patients with disabilities has been shown in previous studies.<sup>[32]</sup> This study also supports previous results. The high QoL is related to the characteristics of the population too, as individuals with a high score on QoL questionnaire, mostly had high levels of education and income and easily accessed recreational facilities. Disabled patients had the lowest score in all aspects of QoL. Some studies emphasis on the role of environment in managing the diseases, especially visual sensory stimulation.<sup>[33]</sup> Neurological disorders are a great point of interest, as diseases like stroke, dementia, and epilepsy directly affect the QoL in the elderly population.<sup>[34-36]</sup> Fear of falling is also under the impression of daily activity and is mostly observed

among aged patients with neurological disorders, such as Parkinson and multiple sclerosis.<sup>[37-39]</sup> Regarding the observance of all principles of randomized controlled trials, from randomization to allocation and concealment is a strength of this study, as the selection and detection biases are reduced to the least levels. Also, the use of standard questionnaires for assessing the QoL of the older population and their self-efficacy is another point of strength in this study. Moreover, to the best of our knowledge, this study is the first to assess the effect of sensory stimulation on QoL of the elderly and their self-efficacy for coping with the fear of falling.

One of the limitations of this study was the short follow-up. As longer administration of sensory stimulation increases their self-efficacy and QoL, further studies with longer periods of intervention are suggested. As this study showed that multistimuli interventions have no effect in terms of the QoL and self-efficacy of fear of falling, it is suggested to conduct further studies with larger sample size and with elderly living in nursing houses. According to a few studies illustrating the higher fall risk in elderly living in nursing houses, a comparison of fall risk in elderly, between the two contexts of nursing houses private house could be considered as a possible point of interest.<sup>[40]</sup>

## Conclusion

According to the results of this study, although some psychological improvements were reported by the individuals in the intervention groups, no significant association between sensory stimulation and QoL in the older population and their self-efficacy for coping with the fear of falling was observed.

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## Conflicts of interest

Nothing to declare.

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