Effect of a Multimodal Exercise Program on Fall Risk among Rural Older Adults

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Abstract

Falls are not a normal part of aging, but may be an important sign of a condition that might be cured or controlled. This quasi-experimental study aimed to evaluate the effect of a multimodal exercise program on fall risk among rural older adults. A multistage cluster sample of 60 older adults subjects who fulfilled the sample inclusion criteria. Two tools were used; Tool I was a structured interview questionnaire to assess elderly demographic characteristics, past and present medical history and fall history, Tool II was the Performance Oriented Mobility Assessment (POMA scale) to determine balance and gait abilities of older adults that measure fall risk. The results revealed that the mean score of fall risk increased from 16.33±4.6 in pretest to 23.95±3.6 post program. The difference was statistically significant (P=000) which indicates statistically significant decreasing in older adults fall risk post the program. The multimodal Exercise program is effective in improving the elderly's fall risk and can be used as an effective non pharmacological intervention to decrease older adults fall risk.

Key words: Multimodal Exercise Program, Fall Risk, Rural Older Adults.

Tob Regul Sci. ™ 2022;8(1): 1543-1554
DOI: doi.org/10.18001/TRS.8.1.120

Introduction

According to World Population Prospects 2019, by 2050, 1 in 6 people in the world will be over the age of 65, up from 1 in 11 in 2019. Population ageing is a global phenomenon: Virtually every country is experiencing growth in the size and proportion of older persons in their population. There were 703 million persons aged 65 years or over in the world in 2019. The number of older persons is projected to double to 1.5 billion in 2050 (United Nations, 2019). In Egypt, the number of older adults aged 60+ years reached 7.63 million; 3.80 million males and 3.82 million females, accounting for 7.6 % of the total population according to the Central Agency for Public Mobilization and Statistics [CAPMAS] (CAPMAS, 2020).

Falls are second only to traffic accidents as the leading cause of injury related deaths among the elderly worldwide, and they are a major cause of both death and injury in people over 65 years of age. According to the World Health Organization (WHO) fall is a major clinical problem in elderly people aged 65 and over, affecting 30%–40% of those living in the community and 50% living in nursing homes (Park, 2018).

Fall is defined as unexpected event in which the older adults come to rest on the ground, floor, or lower level. The term 'recurrent falls' is defined as falling two or more times within the past 12 months, while 'single fall' was defined as falling one time (Jing et al., 2014). The main demographic risk factors is advanced age. The incidence of falls rises with age. Falls in advanced age have serious physical, mental, and socio-economic consequences. Demographic risk factors other than age may include fixed factors, such as gender, and race, and are closely related to serious changes and morbidity, which impair the functioning of the older adults (Kamińska et al., 2015).

Fractures are the most frequently reported physical harm resulting from falls among older adults, accounting for 60% of all fall related injuries. Complications arising from certain types of fractures (e.g. hip joint) may lead to death or immobility; the latter often leads to secondary health problems, such as weakness, constipation, reduced fitness, social isolation and reduced quality of life (Jung et al., 2014). Hip fractures are among the most profound outcomes of falls in older adults due to detrimental effects on functional capacity, independence and mortality. The vast majority of hip fractures are preceded by a fall. While predisposing risk factors such as high age and comorbidities indicate susceptibility to hip fracture (Leavy et al., 2015).

Psychological consequences such as fear associated with falls might be just as detrimental for the individual in the long term. Together they may lead to disability, need for care, and loss of independence, greatly affecting one's quality of life (QoL) (Schoene et al., 2019). Falls can limit daily activities and induce post-fall syndromes, such as dependence, loss of autonomy, immobilization, and depression. They represent one of the main medical misfortunes observed in this population and are considered a public health problem because of its high incidence (Neto et al., 2017).

Some older adults appear to engage in risk taking behaviors that increase their falls risk such as not pressing the call bell when needing to walk to the toilet, or not waiting for nurses to arrive before attempting to mobilize, when they are unsafe to walk without supervision. Particularly for people with poor balance or gait disorders, there is an increased falls risk in hospital. Up to 80% of falls occur when patients are not observed. Some patients initiate risky decisions about mobility based on their own judgments without always seeking help from nurses or other health professionals. Therefore, education is an aspect of most hospital fall prevention programs (Staggs et al., 2014).

Aim of the study

The aim of the current study was to evaluate the effect of a multimodal exercise program on fall risk among rural older adults

This aim would be fulfilled through the following objectives:-

1. Examine fall risk in older adult's pre and post a multimodal exercise program.
2. Develop and evaluate the effect of a multimodal exercise program on fall risk in older adults

Research Hypothesis:

Fall risk in older adults will be decreased after implementation of a multimodal exercise program

Methods

Study Design and Ethical Considerations

A quasi-experimental design was used to conduct the current study. The fieldwork was carried out within the period of six months, starting from the beginning of March 2021 up to the end of August 2021 at Kafar El shiekh Mosa Amran, Zagazig District, Sharkia Governorat, Egypt. The study was approved by the Research Ethics Committee (REC) and the Postgraduate Committee of the Faculty of Nursing at Zagazig University, Egypt. Verbal consent was obtained from the patients after a description of the purpose of the study

Sample size calculation:

Assuming that mean ± SD of POMA B score after 6 months in intervention group and in control group is 10 ±7.5 versus 6 ±5, respectively (Kovács et al., 2013). So sample size was calculated by open Epi program to be 60 participants with confidence level of 95% and power of test 80%.

Sample:

A multistage cluster sample was used in this study that comprised of 60 older adults. The older adults participated in the current study were fulfilled the following criteria

- Able to move and perform activity of daily living .
- Able to cooperate and agree to participate in the study .
- Free from communication problems (speech and hearing problems

Exclusion criteria:

- Older adults have any health disorder that might affect balance and (Parkinsonism and paralysis)
- Bedridden older adults.
- Older adults with psychiatric diseases.
- Older adults receiving physiotherapy sessions.

Sampling technique :

A Multistage cluster sampling technique was used in the recruitment of this study subjects as follows :

- First stage (selection of district): The study was conducted in Sharkia Governorate, which

consists of 13 districts. The investigator used simple random sampling technique to pick up a random district, it was Zagazig district (consists of 75 villages).

- Second stage (selection of village): The investigator picked up one village from the 75 villages randomly (Kafar El Sheikh Mosa Amran).
- Third stage (selection of elderly people): The selected village was divided into 17 clusters. From each clusters four streets were selected randomly.

All the elderly people in the selected clusters were included in the study sample till reaching the calculated sample size.

Tools of Data Collection:

Tool I: A structured interview questionnaire that was developed by the researcher after reviewing the related literature. It composed of demographic characteristics of the study sample such as; age, sex, marital status, educational level, current occupation, monthly income and crowding index, two questions about having chronic diseases such as: diabetes hypertension, gastrointestinal diseases, respiratory diseases, renal diseases, cardio-vascular diseases, liver diseases arthritis and osteoporosis …etc. and medications use and finally involved falling history (number of falls and fear of fall).

Tool II: The Performance Oriented Mobility Assessment (POMA scale): This questionnaire was developed by (Tinetti, 1986) in order to determine balance and gait abilities of older adults. It was consisted of two parts:

Part1. Balance test (POMA B): it consisted of 9 questions. The Balance related items were (sitting balance, arises, attempts to arise, immediate standing balance, standing balance, nudged, eyes closed, turning 360°, and sitting down.

Part2. Gait test (POMA G): it consisted of 7 questions. The gait related items were (initiation of gait, step length, step symmetry, step continuity, path, trunk and walking stance).

The total number of POMA scale questions is 16 (7 related to gait and 9 related to balance). These questions evaluated on three point ordinal scale, ranging from 0-2. "0" indicates the highest level of impairment and "2" the older adult's independence. The total score for the gait component is 12 points. The total score for the balance component is 16 points, with higher scores indicating better gait and balance. The maximum total score of balance and gait (POMA T) is 28 points. Score, 25-28 points = low fall risk, scores 19-24 points = medium fall risk and scores below 19 are at a high risk for falls. In this study, Cronbach's alpha for this scale was 0.76

The multimodal exercise program

It was implemented in the study setting in the form of eleven sessions for small groups (4 to 5 older adults). This was intended to give more chance for discussions, interactions, and practical training. The total sample was divided into small groups (4 to 5 older adults in each group). All groups received the same content using the same teaching methods, media (as point presentations, posters, and pictures), discussions, and the same booklet.

The following nine sessions were held for all older adults

Session 1: (Time: 45 minutes)

The main objective of this session was to promote older adults knowledge about definition of fall and it's prevalence among older adults, fall risk factors, fall risk assessment methods, complications of fall and interventions to reduce fall risk.

Session 2: (Time: 30 minutes)

The main objective of this session was to help the older adults to identify exercise, types of exercise, and health benefits of exercise and recommendations of exercise in older adults .

Session 3: (Time: 30minutes)

The main objective of this session was to help the older adults perform heel to toe exercise correctly .

Session 4: (Time: 30 minutes)

The main objective of this session was to help the older adults perform the sideways walking exercise correctly.

Session 5: (Time: 30 minutes)

The main objective of this session was to help the older adults perform stand on one leg exercise correctly.

Session 6: (Time: 30 minutes)

The main objective of this session was to help the older adults perform sit to stand exercise correctly.

Session 7: (Time: 30 minutes)

The main objective of this session was to help the older adults perform side arm raises exercise correctly.

Session 8: (Time: 30 minutes)

The main objective of this session was to help the older adults perform knee extensions exercise correctly.

Session 9: (Time: 30 minutes)

The main objective of this session was to help the older adults perform standing harm string curls exercises, shoulder and upper arm stretching exercises correctly.

Data analysis:

Data entry and statistical analysis were done using SPSS 23.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations and medians for quantitative variables. Cronbach alpha coefficient was calculated to assess the reliability of the study tool through their internal consistency. Quantitative continuous data were compared using the non-parametric Mann-Whitney or Kruskal-Wallis tests and paired t test. Qualitative categorical variables were compared using chi-square test. Whenever the expected values in one or more of the cells in a

2x2 tables was less than 5, Fisher exact test was used instead. Spearman rank correlation was used for assessment of the inter-relationships among quantitative variables and ranked ones. In order to identify the independent predictors of fall risk, multiple linear regression analysis was used and analysis of variance for the full regression models was done. Statistical significance was considered at p-value <0.05.

Results

Table 1 reveals that the older adults' age ranged between 60 and 83 years, with mean 68.2 ± 6.2 years, with more females (75%). In addition, 68.3% of the studied older adults were married and illiterate and 83.3% of them weren't working currently. Furthermore, 71.7% of the studied older adults had sufficient income and 66.7% of them were having chronic diseases. As well as, 56.7% of them were on regular medication. As regards history of falls, 80% of older adults had previously fallen. Moreover, 30% of them fall three times.

Regarding fall risk, table 2 indicates that the mean score of fall risk increased from 16.33±4.6 in pretest to 23.95±3.6 post program. The difference was statistically significant (P=000) which indicates statistically significant decreasing in older adults fall risk post the program (the higher fall risk total score, the lower the risk of fall). Before the program 71.7% of the older adults had high fall risk which declined to 6.7% at post program phase. The improvements in fall risk levels were highly statistically significant.

Regarding fall risk score, this score had statistically significant negative correlations with age and unmarried status and disease number. Meanwhile there were statistically significant positive correlations between fall risk score and having no chronic disease and taking medication regularly according to table 3.

As noticed from table 4, the statistically significant independent negative predictors of fall risk score were age and number of falls. The model explains 41% of variation in fall risk scale score.

Discussion:

Pre the multimodal exercise program, the current study demonstrated that increased fall risk (total fall risk mean score = 16.33±4.6), majority of the studied older adults had high level of fall risk and minority of participants had low level of fall risk .This might be attributed to lifelong aging process, comorbidities, and previous history of fall and not working status that leads physical inactivity which the major cause of fall. For supporting this rationale, the current study revealed that the majority of studied older adults were not working and had previous fall and more than two thirds of the studied older adults had chronic disease.

Post multimodal exercise program implementation, the findings revealed that there was a statistically significant improvement in total mean score of fall risk (23.95±3.6) among the studied older adults. This might be attributed to improvement in fall risk factors (e.g. gait and balance alteration). These results go in line with the study carried by Liu-Ambrose et al., (2019) in Canada that assumed that 236 falls occurred among 172 participants in the exercise group vs

366 falls among 172 participants in usual care. Fall rates were lower in the exercise group compared with usual care. The estimated fall rate incidence was 1.4 per person-year in the exercise group and 2.1 per person-year in the usual care group. In the same line, Sherrington et al., (2020) in Australia investigated that exercise interventions that include multiple categories of exercise (most commonly balance and functional exercises plus resistance exercises) probably reduce the rate of falls by 34% compared with controls.

Additionally, Cheng et al., (2018) in China found that Compared to usual care, exercise intervention demonstrated the greatest efficacy (OR: 0.64, 95% CrI: 0.53 to 0.77) while the effect of medical care performed the worst (OR: 1.02, 95% CrI: 0.78 to 1.34). Exercise appear to be effective to reduce falls among older adults, and should be considered first as service delivery option for fall risk decrease.

Additionally, the current study demonstrated statistically significant negative correlations between ages mean score with fall risk score (the higher the age, the lower fall risk score). As well, the age was the statistically significant independent negative predictors of fall risk score according to best fitting linear regression. This might be attributed to there is reduction of muscle strength and elasticity, a decrease in bone mass, impairment of joint stability and dynamics, and sensory, vestibular and somatosensory and nervous system disorders. This set of modifications has an impact on the mechanisms of postural control, leading to disturbances in gait, balance and posture. This cascade of changes, besides making it difficult to carry out activities of daily living, predisposes the elderly to fall.

These results were in the same line with the study done by Monachan et al., (2020) in South Kerala, India stated that age was found to be significantly associated with the risk of fall. As the age advanced, old participants were more likely to be at the risk of fall ($P < 0.001$) as the fall risk was 23% between age groups (60yrs -70 yrs.) and 51.4% between age group (70yrs-80yrs) and 90% in participants over 80yrs.

Conclusion

Based upon the findings of the present study and answer of hypothesis, it can be concluded that pre the multimodal exercise program the studied elderly had increased fall risk and the applied multimodal exercise program was effective in improving studied elderly fall risk.

Recommendations

In view of the current study findings, the multimodal Exercise program can be used as an effective non pharmacological intervention to decrease older adults fall risk, the multimodal exercise program should be implemented in the study setting on a long term basis and in similar setting to confirm its effectiveness. Moreover, replication of the study using a larger probability sample from different urban areas to help for generalization of the results

Declaration of Conflicting Interests

The author declares that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Table 1: Demographic characteristics, Medical history and fall history of the studied elderly (N=65)

Demographic characteristics	(n=60)	
	Frequency	Percent
Age group: /year		
60 < 70	38	63.3
70 < 80	16	26.7
≥ 80	6	10.0
Mean ± SD	**68.2 ± 6.2**	
(range)	**(60 – 83)**	
Gender:		
Male	15	25.0
Female	45	75.0
Marital status:		
Married	41	68.3
Widower/ divorced	19	31.7
Education:		
Illiterate	41	68.3
Read & write& basic education	15	25.0
Intermediate education	4	6.7
Current occupation:		
Working	10	16.7
Not working	50	83.3
Monthly Income:		
Sufficient	43	71.7
Insufficient	17	28.3
Have chronic diseases:		
Yes	40	66.7
No	20	33.3

On regular medication	34	56.7
Yes	26	43.3
No		
Number of falls		
Once	15	25.0
Twice	15	25.0
Three times ≤	18	30.0
Never fallen	12	20.0
Fear of falling again n=48		
Yes	47	78.3
No	1	1.7

Table (2): Total mean score of Performance Oriented Mobility Assessment (POMA scale) and levels of fall risk among the studied older adults throughout the study phases (n=60)

Performance Oriented Mobility Assessment	Pre (n=60)		Post (n=60)		t-test	(p-value)
	Mean ± SD		Mean ± SD			
Balance tests mean score (POMA B) Out of 16	8.57±3.0		13.85 ± 2.5		18.65	**.000****
Gait tests mean score (POMA G) Out of 12	7.77±1.9		10.1±1.3		14.37	**.000****
Total fall risk mean score Out of 28	16.33±4.6		23.95±3.6		22.77	**.000****
Levels of Fall Risk	Pre (n=60)		Post (n=60)		X2 Test	(p-value
	no	%	no	%		
Low fall risk	2	3.3	34	56.7	54.0	**.000****
Medium fall risk	15	25.0	22	36.7		
High fall risk	43	71.7	4	6.7		

Table (3): Correlation between fall risk scores post the program and older adults' characteristics

Spearman's rank correlation coefficient	
scores	**Fall risk**
Age	-.523**
Marital status [unmarried]	-.374**
Current occupation [not work]	-.109
Had chronic diseases [no]	.383**
Disease number	-.312*
Taking medication regularly [yes]	.393**
Number of falls	-.004

statistically significant at p<0.01**(**)** Statistically significant at p<0.0 **(*)**

Table (4): Best fitting multiple linear regression model for fall risk score

Items	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	34.295	5.993		5.722	**.000**	22.102	46.488
age	-3.156	1.213	-.383	-2.602	**.014**	-5.624	-.688
Current job [not work]	-3.136	2.002	-.229	-1.566	.127	-7.210	.937
On regular medication	.611	1.603	.053	.381	.706	-2.650	3.871
Number of falls [≥3times]	-2.958	1.368	-.300	-2.162	**.038**	-5.742	-.175
diseases number	-2.153	1.486	-.219	-1.449	.157	-5.176	.870

R-square=0.41 Model ANOVA F=3.82 p<0.05
Variables entered and excluded: gender, educational level &marital status.

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