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RESEARCH ARTICLE

The Physical Activity and Fall Risk Among Iranian Older Male Adults

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Abstract:

Background:

Fall is a major cause of disability and mortality in the elderly.

Objective:

The aim of the present study was to investigate the relationship between the level of physical activity and falls in elderly men in Tehran.

Methods:

The subjects of this study included 434 elderly males over the age of 60 in Tehran, who were randomly selected from parks in different parts of Tehran. The data was collected from August to September, 2019. The demographic characteristics of the subjects were collected and recorded. Then, body composition and anthropometric indices including weight, body mass index (BMI), height and calf circumferences (CC), waist circumferences (WC) and hip circumferences were measured using a digital scale of OMRON and meter tape. The level of physical activity and nutritional status were calculated using the questionnaires of physical activity scale for the elderly (PASE) and mini nutritional assessment (MNA), respectively. The Short Physical Performance Battery (SPPB) test was used to assess the risk of falling. Statistical analysis of data was performed using SPSS21 software.

Results:

The results of statistical analysis of the data showed a positive and significant relationship between global physical activity level ($P<0.000$) and subscales of its domains ($P<0.000$) with fall score and a significant inverse relationship between age and fall score ($P<0.000$). In addition, it was found that age ($P<0.000$) and physical activity ($P<0.000$) are two strong factors in predicting falls in the elderly.

Conclusion:

Based on the resulting positive relationship between physical activity and falls, it can be stated that the using strategies such as increasing sports environments with a focus on exercise, physiologists can play an effective role in preventing falls and related complications in the elderly.

Keywords: Aging, Fall, Health, Dicasability, Physil activity, Physical Performance, Nutritional status.

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1. INTRODUCTION

Aging is a multifaceted irreversible process that is associated with a significant decrease in muscle mass, neuromuscular functions, and a decrease in functional capacity [1]. The growth of the elderly population in recent years has been accompanied by many concerns regarding community health. According to the report of the World Health Organization (WHO) in 2018, the number of people over 60 will increase from 12 percent in 2015 to 22 percent in 2050, with 80 percent living in low- to middle-income countries [2]. Currently, the population of Iran, the same as many developing countries, are aging due to a significant reduction in fertility rates and increased life expectancy, that the number of people over the age of 60 in 2016 have been reported to be 9.3% [3]. It is also projected to reach 21.7% by 2050 [4], which places Iran among the countries having the most elderly population.

Aging is associated with a variety of conditions, such as dementia, delirium, falls, sarcopenia, dizziness, and urinary incontinence, in which physicians often use the term geriatric syndrome to describe the condition. In fact, the geriatric

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syndrome is a set of conditions that occur together to lead to a particular disease or each of the symptoms alone causes a disorder in individuals [5]. Fall is the most common problem and one of the main causes of unintentional injury and premature death in the elderly [6, 7]. Injuries from falls are associated with loss of performance, disability, problems with daily activities and loss of independence, resulting in great healthcare costs [7]. According to the WHO report, in 2018, annually 646,000 death-related falls occurred worldwide. Also, 37.3 million people require hospitalization and medical care each year, of which 17 million suffer from disability-adjusted life years (DALY) [8]. In addition, it has been reported that fall affects approximately 30 percent of people over 65 years and 50 percent of people aged over 80 years [9]. Many factors such as sedentary lifestyle, side effects of various diseases and medications, nutritional disorders, poor sleep quality and visual impairments lead to physical disability, muscle weakness, unsteady gait, imbalance, cognitive disorders and depression in the elderly, all of which are associated with an increased risk of fall [6].

Many interventions, including regular physical activity, diet modification, the use of special shoes, and consumption of medicines have been used to reduce fall rates and improve the quality of life in the elderly [10]. Due to the side effects of medicine on different body systems, we can largely prevent performance reduction and damage caused by aging through lifestyle modifications such as increasing levels of physical activity and proper diet. Also, it has been reported that physical activity, improved quality of life and body composition can prevent many diseases such as geriatric syndrome, hypertension and cardiovascular diseases [11 - 14].

Today, inactivity is recognized as the fourth leading cause of mortality in the world [15]. Jefferies *et al*. in 2014 found that elderly people with sedentary lifestyles are more likely to suffer from falls and related injuries [16]. The results of studies conducted in Iran suggest a low level of physical activity in the elderly [15]. As a result, it is important to examine the relationship between physical activity and various aspects of health in the elderly. As recommended by WHO, the elderly should do moderate-exercise training 300 minutes per week or perform vigorous-exercise training 150 minutes per week to get the optimal health benefits and significantly reduce the likelihood of geriatric syndrome [17]. The study of Sanchez *et al*., in 2012, reported that the risk of falls in the elderly who do daily activities (including shopping, washing the dishes, walking, *etc*.) is significantly lower than sedentary and inactive elderly [18]. Also, Tan *et al*., in 2014, reported that increased participation of the elderly in the indoor and outdoor activity leads to improved fall risk factors [19].

To our knowledge, few studies in Iran have examined the relationship between physical activity levels and the risk of falls in the elderly [6, 7, 10, 16, 18]. On the other hand, given the increasing trend of aging in Iran, the importance of research on the elderly as well as the previous literature, we hypothesized that low levels of physical activity and aging are positively associated with increased risk of falling in the elderly.

2. MATERIAL AND METHODS

2.1. Subjects

A cross-sectional correlation study was conducted among Iranian older male adults from August to September 2019. The sample size was determined in G*Power application according to the F value in ANOVA analysis, 95% confidence interval, 80% test power, and an average effect size of 0.15. Tehran was divided into north, south, east, west and center. Then, five different parks were randomly selected from these regions. A sample of 434 community-dwelling older adults was selected by the convenience sampling method. Before participating in the study, all subjects who met the inclusion criteria were informed of the study purpose and gave their consent for participation. The researcher ensured that participants' identity and what they said or did during the research will be kept confidential. In addition, they were given a detailed explanation regarding the study's purpose and methods. The research protocol was approved by the Health Committee of the Information Services Corporation (Iran).

2.2. Exclusion and Inclusion Criteria

The inclusion criteria were subjects aged 60 years or older living in Tehran. Subjects were excluded if they had neurological problems such as Parkinson's disease and stroke, cognitive impairment, severe verbal and auditory impairments or any medical condition that affect their participation in the physical performance tests and interviews.

2.3. Data Collection

primary assessments were done by using a demographic questionnaire covering basic data and medical comorbidities. Then physical examination including weight, height, body mass index (BMI), waist circumference, hip circumference and calf circumference was carried out. Height and weight were measured by measuring tape to the nearest 0.1cm and OMRON digital scale to the nearest 0.1 kg with subjects dressed in light clothing. Calf circumference (cc) and hip circumference were measured at the greatest dimensions and waist circumference (WC) was measured at the end of natural breaths, a midpoint between the top of the iliac crest and the lower margin of the last palpable rib. Waist-hip ratio (WHR) was calculated by dividing WC (in cm) by hip circumference (cm). The BMI was calculated as weight (kg)/height squared (m2) and classified into underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2) and obese (>30 kg/m^2).

2.4. Physical Activity Assessment

Physical Activity Scale for the Elderly (PASE) was used to quantify the level of physical activity in the elderly. PASE provides us the amount of physical activity undertaken over a one-week period in three domains of occupation, household and leisure by assessing duration, frequency and intensity in each question. The global score of the subjects is calculated by summing the score of all questions in which higher scores indicate higher levels of physical activity. The validity and reliability of the questionnaire in the Iranian population with Cronbach alpha 0.97% have been confirmed [20]. Physical

activity level was divided into sedentary (0-40 points), light physical activity (41-90 points) and moderate to intense activity (more than 90 points).

2.5. Fall Risk Assessment

Short Physical Performance Battery (SPPB) is a test commonly used to assess lower limb strength of elderly subjects. It consists of three tests; tandem tests, five timed chair stands, and a gait speed which evaluates static and dynamic balance, the strength of lower limbs and coordination. Each test is scored between 0-4 which when summed, gives a total SPPB score ranging from 0 to 12, with higher scores indicating better performance. The SPPB is a reliable and valid test to screen the risk of falls in the elderly. Studies have shown that poor scores in the SPPB have been associated with an increased risk of falls [21 - 23]. In the current study, SPPB<6, 7-9 and >10 were suggested to have a low, moderate and high risk of falling respectively.

2.6. Nutrition Assessment

Mini Nutritional Assessment (MNA) is a reliable test which screens nutritional status in the elderly. MNA has been translated and validated in the Iranian population. In the current study, 6 screening questions were used with a score of less than 7 points reflecting malnutrition, 8-11 points at the risk of malnutrition and more than 12 points being well-nourished [24].

2.7. Statistical Analysis

All analyses were performed using the SPSS version 21.0; also, statistical tests were two-tailed, and a p-value of <0.05 was considered to be statistically significant. Subjects' characteristics were analyzed using means ±standard deviations for continuous variables, and frequencies and percentages for categorical variables. For continuous variables, normal distributions were tested using the Kolmogorov-Smirnov test. Also, Pearson and Spearman correlation coefficient tests were used to determine the relationship between continuous and categorical variables. The differences among groups were compared by independent t-test.

After controlling the age variable, linear regression was used to determine the predictability of fall risk regarding physical activity.

3. RESULTS

The characteristics of the elderly are summarized in Table **1**. The mean age of subjects was 70.31±7.54 years with more than half of them aged between 60-70. The most prevalent chronic diseases were hypertension 183 (42.86%), and cardiovascular diseases 143 (33.49%) and arthritis 137 (32.08%). Also, 249(57.11%) subjects reported two or more diseases.

As indicated in Table **2**, 8 (38.10%) subjects who were at a high risk of falling were aged 80-90 years. Of 247 subjects aged 60-70, 202 (81.78%) were at low risk of falling.

96(73.84%) of the normal BMI subjects were at the low-risk of falling. Also, 151 (75.87%) overweight subjects possessed a low chance of falling. However, the majority of high-risk subjects were overweight. More than 70% of completely nourished subjects were in the low-fall risk group. In addition, 8 and 12 subjects of the high-risk groups were well-nourished and at the risk of malnutrition respectively. Only 1 out of all high-risk of falling subjects was malnourished. Moreover, most of the high falling risk subjects were known sedentary. On the other hand, 84% of the subjects, who had moderate to intense physical activity, had a lower likelihood of falling. Of 434 subjects, 314 were sufficiently active (PASE ≥90) while the amount of physical activity of 110 individuals was lower than the recommended value. In addition, 78 individuals were free of chronic disease while 47 out of 193 individuals who had 2 or 3 morbidities were found to be at moderate risk of falling.

The association of physical activity and its domains with fall risk, age, and calf circumference is presented in Table **3**. Pearson correlation analysis showed a significant positive correlation between SPPB and global PASE score ($r= 0.286$, $p < 0.01$), and its domains; leisure time activity ($r= 0.198$, $p < 0.01$), household activity ($r=0.209$, $p < 0.01$) and work-related activity ($r=0.206$, $p<0.05$) scores. This indicates that with an increase in the PASE score, the likelihood of falling decreases. Furthermore, age was found to negatively correlate with PASE score ($r=-0.103$, $p<0.05$), SPPB score ($r=-0.332$, $P<0.01$) and calf circumference ($r=-0.095$, $P<0.05$). Also, there was a significant positive correlation between calf circumference and MNA scores ($r=0.191$, $p<0.01$).

Subjects were divided into low, moderate and high risk of falling groups to compare age, physical activity level and its subscales and nutrition status accurately. The results of 1-way ANOVA showed that there was a significant difference in age ($F=19.10$, $p<0.01$), global PASE score ($F=13.80$, $p<0.01$) and its leisure domain($F=7.81$, $p<0.01$) and household domains ($F=7.35$, $p<0.01$) between all three fall-risk groups. However, there was no significant difference in MNA and calf circumference between groups (Table **4**). The Games-Howell and Bonferroni tests were used to identify which groups had a significant difference. A significant difference was found in the age between low and moderate ($p<0.01$), and high-risk groups ($p<0.05$). There was a significant difference between low and moderate and high risks groups ($p<0.01$) in terms of physical activity levels (global PASE). Also, the leisure domain of PASE was significantly different between low and moderate risks of falling ($p<0.01$) plus a significant difference was found between low and high-risk groups($p<0.05$). There was a significant difference between low and high-risk groups in terms of household activity. Moreover, there were significant differences between all groups in terms of work-related activity.

Linear regression was used to assess whether physical activity level significantly predicts the risk of falling as shown in Table **5**. The result of the regression suggested that physical activity level explained 17% of fall risk $F (2,419) = 44.472$, $p<0.001$. The level of physical activity significantly predicted falling in the elderly $ß= 0.26$, $t=5.74$, $p<0.001$. In fact, according to Table **6**, with a one-unit increase in the PASE score, the score of SPBB increases by 0.26unit.

Table 1. Demographic data of subjects

Variables	-	Mean±SD	N (%)
Age(years)	60-70 71-80 81-90	70.31±7.54	250 (57.34%) 137 (31.42%) 47 (10.78%)
Height (cm)	-	168.01±6.72	-
Weight (kg)	-	76.12±12.22	-
BMI (kg/m^2)	-	26.96±3.87	-
Education	Not literate	-	27 (6.40%)
	Primary school	-	181 (42.89%)
	Middle school/ diploma	-	106 (25.12%)
	Bachelor	-	92 (21.80%)
	Master/PHD	-	16 (3.79%)
Marriage	Single	-	7 (1.62%)
	Married	-	396 (91.45%)
	Widow/Divorced	-	30 (6.93%)
Prescribed Medications	Glucose lowering drugs Lipid-lowering drugs Hypertension drugs	-	98(22.47%) 133(30.50%) 165(37.84%)
Diseases	Hypertension	-	183 (42.86%)
-	CVD	-	143 (33.49%)
-	Arthritis	-	137 (32.08%)
-	Diabetes	-	109 (25%)
-	Kidney	-	48 (11.24%)
-	Liver	-	23(5.27%)

BMI: Body mass index, CV: cardiovascular disease

Table 2. Frequency distribution of age, BMI, malnutrition, physical activity level, diseases and the risk of falling in the three groups

Risk of falling	-	Low	Moderate	High	Significance
	-	No (%) mean±Sd			-
Age(year)	60-70 71-80 81-90	202 (64.33%) 90 (28.66%) 22 (7.01%)	38 (42.70%) 35 (39.32%) 16 (17.98%)	7 (33.33%) 6 (28.57%) 8 (38.10%)	-
BMI(kg/m^2)	Underweight Normal Overweight Obese	2 (0.64%) 96 (30.87%) 151 (48.55%) 62 (19.94%)	2 (2.25%) 28 (31.46%) 37 (41.57%) 22 (24.72%)	0 6 (28.57%) 11 (52.38%) 4 (19.05%)	-
MNA	Malnourished At risk of malnutrition Well-nourished	12 (3.85%) 121 (38.78%) 179 (57.37%)	3 (3.37%) 39 (43.82%) 47 (52.81%)	1 (4.76%) 12 (57.14%) 8 (38.10%)	-
PASE	Sedentary Light physical activity Moderate to intense physical activity	59 (18.79%) 94 (29.94%) 161 (51.27%)	26 (29.21%) 35 (39.33%) 28 (31.46%)	13 (61.90%) 6 (28.57%) 2 (9.52%)	-
PASE	Mean	103.74	75.52	46.46	0.000
Number of diseases	0 1 2-3 4>	59 (19.03%) 79 (25.49%) 137 (44.19%) 35 (11.29%)	16 (18.61%) 12 (13.95%) 47 (54.65%) 11 (12.79%)	3 (15%) 5 (25%) 9 (45%) 3 (15%)	-

Table 3. Correlation between falling criteria and age, PASE, MNA and calf circumference

		Age	CC	PASE-leisure	PASE-household	PASE-work	PASE-global	MNA	SPPB score
Age	R p	1	-.095* .049	-.034 .485	-.095* .049	-.157** .001	-.103* .032	.052 .284	-.332** .000
CC	R P	-	1	-.109* .025	-.032 .514	-.031 .525	-.080 .100	.191** .000	.006 .896

(Table 3) cont.....

PASE-leisure	R p	-	-	1	.261** .000	.013 .788	.643** .000	.078 .109	.198** .000
PASE-household	R p	-	-	-	1	-.013 .792	.780** .000	-.016 .740	.209** .000
PASE-work	R p	-	-	-	-	1	.268** .000	-.002 .747	.206** .000
PASE-global	R p	-	-	-	-	-	1	-.005 .918	.286** .000
MNA	R p	-	-	-	-	-	-	1	.006 .901
SPPB	R P	-	-	-	-	-	-	-	1

Correlation is significant at the 0.05 level (2-tailed).
Correlation is significant at the 0.01 level (2-tailed).

Table 4. ANOVA results of fall risk, regarding age, calf circumference, physical activity levels and malnutrition variables

	Dependent variables		**SS**	**MS**	**F**	**P**	-	-	**P**
The risk of falling	Age	1876.69		928.34	19.10	**0.000**	High	Moderate	0.944
								Low	**0.040***
							Moderate	High	0.944
								Low	**0.000****
							Low	High	**0.040***
								Moderate	**0.000****
	PASE	109250.4		54625.2	13.80	**0.000**	High	Moderate	0.086
								Low	**0.000****
							Moderate	High	0.086
								Low	**0.001****
							Low	High	**0.000****
								Moderate	**0.001****
	PASE-Leisure	16747.5		8373.73	7.81	**0.001**	High	Moderate	0.786
								Low	**0.014***
							Moderate	High	0.786
								Low	**0.007****
							Low	High	**0.014***
								Moderate	**0.007****
	PASE-Household	23859.2		11929.6	7.35	**0.001**	High	Moderate	0.055
								Low	**0.001****
							Moderate	High	0.055
								Low	0.198
							Low	High	**0.001****
								Moderate	0.198
	PASE-work	4190.75		2095.37	7.35	**0.001**	High	Moderate	**0.043***
								Low	**0.000****
							Moderate	High	**0.043***
								Low	**0.000****
							Low	High	**0.000****
								Moderate	**0.000****
	MNA	4.01		2.00	0.502	0.606	High	Moderate	1.000
								Low	0959
							Moderate	High	1.000
								Low	1.000
							Low	High	0959
								Moderate	1.000

(Table 4) cont.....

-	CC	26.37	13.18	1.096	.335	High	Moderate	0.473
-							Low	0.442
-						Moderate	High	0.473
-							Low	1.000
-						Low	High	0.442
-							Moderate	1.000

*. The mean difference is significant at the 0.05 level.**. The mean difference is significant at the 0.01 level.

Table 5. Summary of Linear regression

Steps	predictors	R^2	ΔR^2	SE_E	R^2 Change	F change	Sig. F change
1	Age	0.110	0.108	1.608	0.110	52.039	0.000
2	Age, PA	0.175	0.171	1.551	0.065	32.946	0.000

Table 6. Regression analysis for variables predicting fall risk

Steps	Model	B	SE	ß	t	P
1	Age	-0.72	0.01	-0.307	-6.89	0.000
2	PA	0.007	0.001	0.256	5.74	0.000

a predictor, age,
b predictors, age, physical activity
Dependent Variable: fall

4. DISCUSSION

Extending longevity requires maintaining a good quality of life and identifying cost-effective and safe interventions to prevent and control symptoms associated with the geriatric syndrome. Falling is one of the most serious problems in the elderly, which is seen in about 30% of people over the age of 60 and is the sixth leading cause of death in the elderly [1]. In addition, the reduced functional capacity in the elderly is associated with a decline in quality of life and disability to perform daily tasks [25].

The results of several studies show that gait disturbance and imbalance, functional disorders, visual and cognitive impairments are considered as the major risk factors for falls in the elderly and physical activity has been known as a positive factor in the prevention and treatment of various diseases, symptoms reduction of the geriatric syndrome and the risk of falling [25, 26]. Therefore, the purpose of this study was to investigate the levels of physical activity and its relationship with the risk of falls in the elderly in Tehran.

In the present study, there was a positive and significant relationship between total physical activity level and the score of falling (reduced risk of falling) (P <0.000). Also, the level of physical activity in the low-risk falls group (LRF) was significantly higher than the moderate (P <0.001) and high risk (P <0.000) groups. Our results are in line with several findings [27, 28]. Disorders in the release of cytokines have been reported to affect the central nervous system, leading to problems such as falls [6]. On the other hand, increased levels of physical activity and exercise can improve neuromuscular function and prevent falls in the elderly by activating redox-sensitive pathways in skeletal muscle and responses to inflammatory factors [29]. In addition, it has been reported that increased physical activity through exercise is associated with a reduction in bone mineral density (BMD) in the elderly and prevents bone fractures and other injuries that ultimately lead to falls [30]. The high rate of falls in sedentary elderly is due to a decrease in functional capacity, whereas higher rates of falls due to high physical activity generally occur during heavy work and in uncontrolled environments [30]. In the present study, a significant positive relationship was found between physical activity subscales (leisure time, household, and workplace activities) and falling scores.

In the present study, a significant and positive relationship was observed between Leisure-Time Physical Activity (LPA) and the score of falling in the elderly (reduced risk of falling) (P <0.000). Also, the score of LPA was significantly higher in the group of low-risk falls (LRF) than the medium-risk falls (MRF) (P <0.007) and high-risk falls (HRF) (P <0.01). Leisure time constitutes a great part of the day spent by the elderly. Leisure activities include hiking, shopping, recreation and sports activities. The study of Jung *et al*., in 2015, reported that applying strategies to increase leisure-time physical activity is associated with a decreased risk of falls in the elderly, which is consistent with our results [31]. Walking is the most well-known method to increase LPA, which improves the risk of falls by improving the body's physiological function [32]. On the other hand, the increasing development of sedentary behaviors is associated with diseases such as type 2 diabetes and cardiovascular disease in the elderly which increases the risk of falling [31]. As a result, optimal use of leisure time and increased physical activity are essential to prevent falls and improve the health of the elderly in the community.

In the present study, a positive and significant relationship was found between household physical activity (HPA) and the elderly's fall score (P <0.000). Also, the HPA score of the HRF group was significantly lower than the LRF group (P <0.001). Our findings are in line with the results of the studies done by Yun *et al*. And Sanchez *et al*. [18, 33]. The activities of daily

living at home make up a large part of the daytime of the elderly, and most of these activities such as sweeping, gardening, washing dishes, babysitting, *etc*. are done regularly; even some of these activities such as washing the dishes should be taken on a daily basis. Based on the findings of the present study and the results of previous studies, it can be stated that higher HPA done by the elderly helps to reduce the risk of falls via reducing sedentary behaviors during the day and preventing age-related neuromuscular decline. Nowadays, researchers use these techniques to improve and control the risk factors for falls in the elderly [10]. However, given the high percentage of people at risk of malnutrition (39.6%), in this study, it can be said that providing a proper diet regarding age and health status of these individuals is a vital approach to improve nutritional status in order to prevent fall risk factors and improve the health of elderly.

In the present study, a significant positive correlation was found between work-related physical activity (WPA) and the score of falls in the elderly (P <0.000). Also, the mean score of WPA in the LRF group was significantly higher than the MRF (P <0.000) and HRF (P <0.000) groups. Researchers believe that increasing levels of physical activity through proper occupations is one of the ways to prevent falls in the elderly [34]. However, it should be noted that hard and demanding tasks such as moving heavy objects or driving mainly increase the risk of falls in the elderly [34]. Occupational activities in the elderly generally lead to improved risk factors for falls, through enhancing the sense of participation and usefulness, financial independence and improvement of physical factors including prevention of osteoporosis. On the other hand, in the present study, the number of working elderly was very low (17% = 77 persons) and it can be stated that generally, a low percentage of the elderly in Tehran enjoys the benefits of work activities in preventing and improving the factors associated with falling.

In the present study, no significant relationship was found between malnutrition and the risk of falls. Our findings, however, contradicted some studies in this area [35, 36]. Lack of adequate protein, minerals, and vitamins have been reported to play an important role in the progression of muscle atrophy, sarcopenia and increased risk of falls in the elderly [35]. On the other hand, due to the low percentage (3.6%) of malnourished subjects in our study, it can be stated that the subjects generally had a good diet and nutritional problems were not significant among Community-dwelling Older Adults in Tehran.

In the present study, there was no significant relationship between the calf circumference and the risk of falling. This finding is opposed by the study done by Diaz *et al*., in 2016, which reported that elderly people whose leg circumference is less than 31 cm are at increased risk for sarcopenia and consequently falls [37]. Miziara *et al*., in 2013, suggested in their study that the calf circumstance is more commonly used as a factor to assess nutritional status and indirectly for the risk of falls in the elderly [38]. Therefore, the reason for this conflict may be related to the suitable nutritional status of the subjects in this study.

In the present study, we found that the risk of falls in the elderly increased significantly with age (P <0.000), which is in line with prior studies [10]. The mean age in the LRF group was also significantly lower than the MRF (P <0.000) and HRF (P <0.04) groups. Increasing age mainly affects the body's physiological systems, including neuromuscular functions, homeostasis mechanisms, and housekeeping systems, leading to an increased risk of falls [39]. In addition, it has been well proven that the proper function of the nervous system including cortical–basal ganglia loop and the basal ganglia–brainstem system and appropriate processing of sensory information such as vision and hearing are essential for normal walking and to prevent falls [40]. In this context, it has been reported that regular physical activity and exercise can reduce the risk of falls in the elderly by developing physiological adaptations and improving the performance of these systems [39].

CONCLUSION

Given the prevalence of the aging population and the geriatric syndrome, the main focus of this study was on the factors associated with an increased risk of falls in the elderly in Tehran. This study found that physical activity plays a much more eminent role than nutritional status in improving the risk factors for falls and elderly health. As a result, it can be argued that applying strategies to increase physical activity in the elderly, such as increased sports and recreation facilities, providing appropriate occupations for these individuals, as well as regular monitoring of physical and nutritional status along with other medical care can reduce the risk of falling and in addition improve community health, thereby preventing the high cost of care for the elderly. Examination of this factor by other researchers can be of great help to investigate the prevalence of falls in the Iranian elderly.

LIMITATION

This study was constricted to Tehran and this reduces the generality of the results. Also, due to the cross-sectional design, this study was not able to show cause-and-effect relationships as well. Another limitation of this study includes the failure to evaluate the history of falls in the elderly.

LIST OF ABBREVIATIONS

BMI	=	Body mass index,
CC	=	Calf circumferences,
PASE	=	Physical activity scale for elderly,
MNA	=	Mini nutritional assessment,
SPPB	=	Short Physical Performance Battery,
WHO	=	World Health Organization,
DALY	=	Disability-adjusted life years,
WC	=	Waist circumferences,
WHR	=	Waist-hip ratio,
BMD	=	Bone mineral density,
LPA	=	Leisure time physical activity,
HPA	=	House time physical activity,
WPA	=	Work time physical activity,
GPA	=	Global physical activity,
LRF	=	Low risk of fall,

MRF = Medium risk of fall,

HRF = High risk of fall

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research protocol was approved by the Health Committee of the Information Services Corporation (Iran).

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

The researcher ensured that participants' identity and what they said or did during the research would be kept confidential. In addition, they were given a detailed explanation regarding the study's purpose and methods. Informed consent has been obtained from all the participants.

AVAILABILITY OF DATA AND MATERIALS

The authors confirm that the data supporting the findings of this study are available within the article.

FUNDING

None

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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