

The Association between Fear of Falling and Physical Activity in Older Women

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Abstract. [Purpose] Fear of falling is thought to lead to restricted activities. Although fear of falling may reduce physical activity, the association between fear of falling and physical activity measured objectively has yet to be investigated. The purpose of this study was to investigate the association between fear of falling and objective physical activity among older women. [Subjects and Methods] Subjects were 262 older women (aged 65–95 years) who were classified into fear of falling and no fear of falling groups. Demographic data and physical performance were measured. Physical activity was evaluated using a pedometer. [Results] Prevalence of fear of falling was 62.2% (n=163) and that of no fear of falling was 37.8% (n=99). The fear of falling group had a higher prevalence of fall history, higher medication use, lower physical performance and lower physical activity. In regression analysis, fear of falling was found to be independently correlated with physical activity. [Conclusion] Our results suggest that fear of falling is significantly associated with physical activity when measured objectively among older women. To enhance physical activity, a program focused on not only physical function but also psychological factors such as fear of falling should be developed.

Key words: Fear of falling, Physical activity, Older adults

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INTRODUCTION

Fear of falling (FOF) is one of the major psychological factors related to falls. FOF is commonly defined as a continuous psychological state of being afraid of falling and therefore restricting activity¹⁾. Older adults with a fall history are prone to have FOF²⁾. Additionally, FOF has been identified as one of the risk factors for incidence of falls³⁾. Previous research has identified age^{4–6)}, sex (women)^{7, 8)}, physical function^{9, 10)} and global health status^{11, 12)} as factors which lead to the development and aggravation of FOF.

Restriction of activity due to FOF arises from a loss of confidence in performing the activity. Restrictions vary from activities of daily living to socially interactive activities. FOF is associated with physical functions⁹⁾, including gait ability¹⁰⁾ and this association is the result of a loss of confidence. Declines in physical activity among older adults are often related to FOF, while participation in physical activity is believed to contribute to the promotion of health in several domains (e.g., physical, cognitive, cardiovascular health, and even survival rate). A previous study investigated the relationship between physical activity and FOF using an interview or a subjective questionnaire to

assess physical activity³⁾. Ideally though, physical activity among older adults should be assessed using an objective method¹³⁾; because methods used to subjectively evaluate physical activity have the critical limitation of recall bias. One of the validated measures to objectively assess physical activity is the measurement of ambulatory physical activity using a pedometer including accelerometry¹⁴⁾. However, the association between objectively measured physical activity and FOF has yet to be investigated. Therefore, the purpose of this study was to clarify the association between objectively measured physical activity and FOF.

SUBJECTS AND METHODS

Subjects

All subjects were independently living, community-dwelling older women who were members of a “day service” which is provided by a nonprofit organization. A total of 262 older women (aged 65–95 years) volunteered to participate in the study. Inclusion criteria required independence in activities of daily living and independent gait. In addition, all subjects were given permission to participate in this study by their primary care doctor in light of their

Table 1. The general characteristics of the fear of falling and no fear of falling groups

Variables	Mean or proportion \pm SD	
	FOF group, n=163	No-FOF group, n=99
Age, years	80.7 \pm 5.4	80.7 \pm 5.4
BMI, kg/m ²	24.1 \pm 3.9	23.4 \pm 3.6
TUG, s	13.5 \pm 3.7	12.4 \pm 3.6 *
Chronic disease, n (%)		
Hypertension	87 (53.4)	49 (49.5)
Hyperlipidemia	27 (16.6)	13 (13.1)
Diabetes mellitus	17 (10.4)	6 (6.1)
Medication uses, n	4.0 \pm 2.9	3.1 \pm 2.6 *
Fall history, n (%)	65 (39.9)	20 (20.2) *
Limitations of IADL, n (%) [†]	89 (54.6)	53 (53.5)

FOF: fear of falling, No-FOF: no fear of falling, IADL: instrumental activity of daily living, FOF and No-FOF groups were compared using the independent *t* test and χ^2 test., [†]Limitations of IADL: limitation in at least one item of the sub-score of checklist. * Compared with FOF group, *p*<0.05.

medical condition(s). The Medical Ethics Committee of Kobe University Graduate School of Medicine approved this study. Informed written consent was obtained from all subjects in accordance with the Declaration of Helsinki prior to their participation.

Measurements

We recorded general characteristics: height, weight, body mass index (BMI), medical history and medication use. A checklist, used by the long-term care insurance system for elderly people in Japan, was used as a screening tool. This checklist consists of 25 question items related to daily living, and it is generally used to assess functional status. Answer to items on the checklist were collected by interview and instrumental activities of daily living (IADL) were assessed using the sub score of this checklist. There are 5 question items for IADL. The number of limitations in IADL was also recorded. Fear of falling was assessed by an item on the checklist and subjects answered “yes or no” as to whether they had a fear of falling. The assessment of FOF using a questionnaire with a dichotomous (yes/no) answer ensures standardization and reliability amongst elderly subjects^{6, 15}. Subjects with FOF were classified as the FOF group, and those without FOF were classified as the No-FOF group. History of falls in the last year was also collected using the checklist. We defined a fall as an unexpected event in which the participant came to rest on the ground, floor or lower level¹⁶. We excluded falls derived from extraordinary environmental factors (e.g., falls from a ladder).

The timed up and go (TUG) test was used as a physical assessment measure. The TUG test is a mobility test in which subjects are asked to stand up from sitting on a chair, walk 3 meters, turn around and walk back to the chair, and sit down again, at their self-selected normal speed in a well-lit environment¹⁷. Daily ambulatory activity (steps/day) was defined as physical activity (PA), and was assessed using a pedometer including the accelerometer (Kenz Lifecorder-

ex; Suzuken Co., Ltd., Nagoya, Aichi, Japan) which were attached to the waist. This was used for monitoring PA and confirming reliability^{14, 18}. The duration of monitoring PA was 7 days and the average number of steps/day was calculated.

All analyses were performed using commercially available software (JMP8.0 J, SAS Institute Japan, Tokyo) for Windows XP. We conducted parametric statistical analyses after confirming the data were normally distributed. We compared the characteristics of subjects between the FOF and No-FOF groups using the independent *t*-test and the chi-squared test. To assess the association between PA and FOF, we first used univariate analysis. We then used a linear regression model in which PA was the dependent variable and the independent variable was FOF with the following covariates: age, BMI, medication use, TUG time and fall history. Categorical data (FOF versus No-FOF, fall history versus no fall history) were replaced with dummy variables (1 versus 0). Statistical significance was set at *p* < 0.05.

RESULTS

The prevalence of FOF was 62.2% (*n* = 163) and that of No-FOF was 37.8% (*n* = 99). Subjects' characteristics are shown in Table 1. Age, BMI, prevalence of chronic disease and limitations of IADL were not significantly different between the FOF and No-FOF groups. The FOF group reported higher medication use and a higher incidence of falls than the No-FOF group (medication use: *p* < 0.017, fall history: *p* < 0.001). TUG time of the FOF group was longer than that of the No-FOF group (*p* = 0.013).

PA was significantly different between the groups. The No-FOF group had higher PA than the FOF group (FOF group: 4670 \pm 2787 steps/day, No-FOF: 5819 \pm 3190 steps/day, *p* = 0.0025). Results from the linear regression model are shown in Table 2. FOF had a significant association with PA, even though the independent variable and covariates

Table 2. A linear regression model of physical activity

Physical activity		
variables	β	p value
Age	-0.282	<0.0001
Body mass index	-0.133	0.023
Medication uses	-0.023	0.685
Timed up and go test	-0.285	<0.0001
Fall history	-0.008	0.892
Fear of falling	-0.124	0.028
R^2		0.263

A linear regression model was used to examine the association between physical activity and fear of falling.

were included in the model ($p=0.0275$).

DISCUSSION

Our results show that the prevalence of a fear of falling was 62% among our sample of community-dwelling older women. The FOF group had a higher rate of falls, higher medication use and less mobility, suggesting that physical activity is decreased by fear of falling. The regression analysis found that fear of falling was significantly associated with physical activity even after adjusting for other variables.

This study had a relatively higher proportion of subjects with FOF than other studies. FOF is classically defined as a lasting concern about falling that causes individuals to avoid physical activities¹. The extent and degree of restriction of activity due to FOF extends to both activities of daily living and to social activity participation³. The assessment of FOF used in this study differed from those used in previous studies. However, the simple method of asking about FOF (yes/no) had a tendency to estimate higher rates of FOF compared to methods using an efficacy scale or classical FOF restricting activities of daily living^{2, 6}. In addition, emerging review evidence has shown that older women with a lower health status and a history of falls had a higher risk of FOF^{2, 3}. Subjects in our study were only women and of a relatively older age (mean age: 81 years) compared to other studies. This may have contributed to the relatively high prevalence of FOF found in this study. The FOF group had a higher percentage of subjects with a fall history and higher medication use than the No-FOF group. These characteristics and global health status were associated with FOF, consistent with other studies. Therefore, the characteristics of subjects may have contributed to the high prevalence of FOF.

As a result of FOF, physical activity becomes reduced^{2, 3}. However, most studies previously conducted have measured subjective physical activity using a questionnaire. Our results reveal FOF was associated with decreased physical activity as measured objectively using a pedometer. Physical activity is strongly linked with physical capabilities¹³; while decreased physical confidence occurred due to FOF and led to a decline in physical function¹⁹. FOF impacts on several abilities of postural control and/or mobility including

gait ability^{7, 8, 12}. Thus, FOF leads to decreased physical capability and physical function. Moreover, the regression analysis showed that both FOF and physical function were independently correlated with physical activity. Reducing FOF is essential to prevent a debilitating spiral of loss of confidence, restriction of activity, frailty, falls and loss of independence. Some exercise programs (e.g., home-based exercise, tai chi, and multifactorial interventions) have been effective at reducing FOF²⁰. However, exercise programs as an intervention for older adults should be adjusted and modified according to the level of individuals' physical activity. To reduce FOF effectively, exercise programs based on individualized physical activity may be required because older adults with FOF may have decreased levels of physical activity.

Our study had several limitations. First, the design of this study was cross-sectional. To clarify causal relationships between FOF and physical activity, a longitudinal study should be conducted. Second, the subjects of this study were older women who were of a relatively advanced age. For the purpose of generalizing results, other older populations with different characteristics should be investigated. In addition, assessments of FOF have varied, and a standardized questionnaire based on efficacy is recommended².

In conclusion, older women with FOF had decreased physical function and physical activity. FOF independently correlated with physical activity, even after adjusting for covariates including physical function. A reduction of FOF may contribute to enhancement of ambulatory physical activity among older women. Furthermore, a longitudinal and intervention study should be conducted to clarify the relationship between FOF and physical activity.

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