The Ability of Thai-FRAT's Item to Identify Risk of Fall in Elderly With and Without History of Fall

ความสามารถของแบบประเมิน Thai-FRAT รายหัวข้อในการบ่งชี้ความเสี่ยงต่อการหกล้ม ในผู้สูงอายุที่มีและไม่มีประวัติการหกล้ม

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ABSTRACT

An advancing age usually relates to an increasing risk of fall in elderly that may lead to negative impacts of physical, psychological, and socioeconomic consequences. Finally, falls resulted in decrease of quality of life and increase disability. Therefore, early fall risk screening is important. The Thai falls risk assessment test (Thai-FRAT) is developed to measure risk of fall in Thai community-dwelling elderly. However, there are some limitations to apply in elderly who lived in different cultures and environments. Therefore, the study aimed to determine the ability of each Thai-FRAT's item for identifying risk of fall in elderly aged at least 65 years. Participants were interviewed fall history within the past 6 months to divide them into 3 groups including non-faller, single-faller, and multiple-faller groups. They were screened fall risk using the Thai-FRAT which consisted of 6 items. The results showed that the items of having fall history at least 2 falls within the past 6 months and balance impairment using tandem stand test in 10 seconds were statistically significant differences among 3 groups. The findings suggested that fall risk screening can be assessed using these two items to indicate fall risk in elderly.

บทคัดย่อ

อายุที่มากขึ้นมักทำให้ผู้สูงอายุมีความเสี่ยงต่อการหกล้มเพิ่มขึ้น ซึ่งกระทบทั้งทางกาย จิตใจและเศรษฐสังคม ส่งผลให้คุณภาพชีวิตลดลงและเพิ่มภาวะทุพลภาพในที่สุด ดังนั้น การคัดกรองความเสี่ยงต่อการหกล้มตั้งแต่แรกเริ่มจึงมีความสำคัญ ซึ่งแบบประเมินความเสี่ยงต่อการหกล้มสำหรับผู้สูงอายุไทยในชุมชนได้ถูกพัฒนาขึ้น อย่างไรก็ตาม แบบประเมินดังกล่าวยังมีข้อจำกัดในการประยุกต์ใช้สำหรับผู้สูงอายุที่อาศัยอยู่ในบริบทที่แตกต่างกัน ดังนั้น การศึกษานี้จึงมีวัตถุประสงค์เพื่อศึกษาความสามารถของแบบประเมินดังกล่าวรายหัวข้อในการบ่งชี้ความเสี่ยงต่อการหกล้มในผู้สูงอายุที่มีอายุตั้งแต่ 65 ปีขึ้นไป อาสาสมัครได้รับการสัมภาษณ์ประวัติการหกล้มในระยะ 6 เดือนที่ผ่านมา โดยแบ่งออกเป็น 3 กลุ่ม คือกลุ่มที่ไม่หกล้ม กลุ่มหกล้ม 1 ครั้ง และกลุ่มหกล้ม 2 ครั้งขึ้นไป และคัดกรองความเสี่ยงต่อการหกล้มด้วยแบบประเมินความเสี่ยงต่อการหกล้มสำหรับผู้สูงอายุไทยในชุมชนที่ประกอบด้วย 6 หัวข้อ ผลพบว่าการมีประวัติการหกล้มอย่างน้อย 2 ครั้งในระยะ 6 เดือน และความบกพร่องของการทรงตัวเมื่อประเมินโดยการยืนต่อเท้าเป็นเวลา 10 วินาที เป็นหัวข้อที่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติระหว่างอาสาสมัคร 3 กลุ่ม ผลการศึกษาเสนอแนะว่าการคัดกรองความเสี่ยงต่อการหกล้มสามารถประเมินโดยใช้สองหัวข้อนี้ เพื่อบ่งชี้การมีความเสี่ยงต่อการหกล้มในผู้สูงอายุได้

Keywords: Elderly, Risk of fall, Thai-FRAT

คำสำคัญ: ผู้สูงอายุ ความเสี่ยงต่อการหกล้ม แบบประเมินความเสี่ยงต่อการหกล้มสำหรับผู้สูงอายุไทยในชุมชน

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Introduction

An advancing age usually relates to decrement of several body systems which may affect the ability to conduct daily activities (Hebert, 1997a; Hebert et al., 1997b; Lusardi et al., 2003). This is associated with deterioration of physical performance in elderly which may result in an increased risk of fall (Laessoe et al., 2007). Evidences supported that approximately 30% of elderly who aged at least 65 years experienced a fall in each year (Roger et al., 2003; Stel et al., 2004). Unfortunately, the incidence gradually increases with aging which lead to several negative impacts such as pain, bruise, muscle strain, open wound, fracture as well as brain injury (Chu et al., 2007; Stel et al., 2004). Although some events of fall do not refer to any physical consequences, those may lead to other psychological consequences such as fear of fall (Aoyagi et al., 1998). Elderly with fear of fall are reported loss of self-confidence to mobility and restriction of ability in daily activities; finally, it may limit their community participation, decrease quality of life and increase mortality rate (Scheffer et al., 2008; Stel et al., 2004; Vellas et al., 1997). Therefore, an effective method to early detection risk of fall in elderly should be concerned in order to plan an appropriate prevention and intervention (Kim et al., 2017; Gillespie et al., 2012; Lusardi et al., 2003).

Previous study recommended that an early screening is effective preventive fall strategy (Gillespie et al., 2012). Fall screening tool can be categorized into 2 types depending on outcome of measurement including qualitative and quantitative tests (van Hedel et al., 2007; van Iersel et al., 2008). The practical fall risk screening should be comprised of both tests to identify cover all aspects of fall risk in elderly; furthermore, it should be easy to perform in clinical and community setting, take less time consuming and inexpensive (Lusardi et al., 2003; Steffen et al., 2002). Thiamwong et al. (2008) developed the Thai falls risk assessment test (Thai-FRAT) to measure risk of fall in Thai community-dwelling elderly. The Thai-FRAT was developed base on possible fall predictors that consisted of 6 items related to fall risk (Thiamwong et al., 2008). There were female gender, impaired visual acuity, impaired balance ability, take at least four medications or specific medication use, a history of two or more falls within the past six months, and living in a Thai style house. The elderly with high risk of fall were reported Thai-FRAT score at least 4 out of 11 scores with high sensitivity and specificity (0.92 and 0.89, respectively). Although the Thai-FRAT is often used in Thai elderly (Harnirattisai et al., 2015; Jitramontree et al., 2015; Nualnetr et al., 2010), there are some limitations that it may not be fully applied with the elderly in different cultures and environments (Thiamwong et al., 2008). Therefore, the investigation of ability of each Thai-FRAT's item to identify risk of fall in elderly with different fall history may provide the practical screening items. The findings may provide the applicable fall risk screening for health care officers in which it may lead to proper fall prevention in elderly.

Objectives of the study

The aim of this study was to determine the ability of each Thai-FRAT's item for identifying risk of fall in elderly with and without history of fall.

Methodology

Study design and population

This study was a part of major study aiming to determine the responsiveness of four physical performance tests related to independent functional ability in elderly with risk of fall. Thus, the study was preliminary and cross-sectionally conducted in 102 participants who aged at least 65 years, both male and female with a body mass index (BMI) between 18.5 and 29.9 kg/m^2. Additionally, the participants need to understand simple commands and questions in order to complete the protocol of the study. However, they were excluded if they have the inflammation of joint and muscle of lower extremities with pain more than 5 out of 10 scores on a visual analogue scale, or any pain that affect the study, sequelae of neurological disease (e.g. stroke and Parkinson's disease) that affect the ability to perform the tandem stand test, and other signs and symptoms that may influence the study protocols such as dizziness, auditory deficits, acute illness or injury, unstable heart disease (e.g. angina), uncontrolled hypertension. Protocols of the study were approved by the Khon Kaen University Ethics Committees for Human Research, Khon Kaen, Thailand (HE602302).

Experimental protocols

The participants were investigated their demographic characteristics and fall using screening questionnaire. Additionally, they were screened risk of fall using the Thai-FRAT which consists of 6 items of fall predictors. The 6 items include female gender, impaired visual acuity (unable to read more than half of the letters in 6/12 line of a Snellen chart), impaired balance ability (unable to take full tandem stand test for ten seconds), take at least four medications or at least one specific medication (i.e., sedatives/hypnotics, psychotropic drugs, antihypertensive agents, or diuretics), a history of two or more falls within the past 6 months, and living in a Thai style house. Then, the eligible participants were categorized into 3 groups using fall history within the past 6 months including non-faller (no fall), single-faller (one fall), and multiple-faller (at least 2 falls) groups. Fall in this study was defined as an unintentional event which results in a person coming to rest on the ground or other lower levels (Maki et al., 1994; Sheffer et al., 2008).

Statistical analysis

Statistical analyses were performed using the SPSS program (SPSS Statistic version 17.0, IBM Corporation, 1 New Orchard Road Armonk, New York 10504-1722, USA, serial number: 5068054). The descriptive statistics (mean, standard deviation, number and percentage) were used to explain demographic characteristics and findings of the study. The Chi-square test and one-way analysis of variance (ANOVA) were utilized to compare the different findings among 3 groups for categorical and continuous variables, respectively. Every pairwise comparison was further analyzed using the post hoc (Bonferroni) analysis. A level of significant difference was set at less than 0.05.

Result

Demographic characteristics

One hundred and eighteen participants interested to participate in the study; however, 16 of them were excluded due to having age less than 65 years (8 persons), BMI less than 18.5 kg/m^2 (1 person), BMI more than 29.9 kg/m^2 (3 persons), and hearing impairment (4 persons). Therefore, 102 eligible participants were involved in this

study in which an average age was 70.66±4.15 years and most of them were female (64 persons, 62.75%). They were categorized into 3 groups depending on their fall history within the past 6 months. The demographic characteristics including age, weight, height and BMI were no statistically significant differences among groups ($p>0.05$, Table 1).

The findings of Thai-FRAT among 3 groups

Multiple-faller group was reported highest risk of fall with a greater total score of Thai-FRAT than other groups ($p<0.001$, Table 2). However, there were no significant differences of total scores between non-faller and single-faller groups (2.09±1.25 and 2.90±1.66 scores, respectively; $p>0.05$, Table 2). When considered in each item of Thai-FRAT, there were significant differences among groups only for item 3 (balance impairment) and item 5 (a history of fall at least 2 times within the past 6 months) ($p<0.05$ and $p<0.001$, respectively, Table 2). However, the percentage of balance impairment in multiple-faller group (45.45%) was less than single-faller group (68.18%). Additionally, the number of fall in multiple-faller group ranged between 2-4 falls; therefore, the total number of fall was 26 times. More than half of their fall events caused by extrinsic factor or environmental fall hazard (14 events) such as slipping and tripping. Furthermore, causes of intrinsic factor (12 events) were balance impairment, leg muscle weakness, and postural hypotension during changing position. Similarly, almost of single-faller also resulted from extrinsic factor (17 events) such as slipping, tripping, and stumble over uneven paths, whereas the intrinsic cause (5 events) of single-faller included balance impairment and leg muscle weakness.

Table 1 Demographic characteristic of participants (n=102)

Variable[a]	Group			p-value
	Non-faller (n = 69)	Single-faller (n = 22)	Multiple-faller (n = 11)	
Age (year)	70.77±4.11 (69.78-71.76)	70.23±4.33 (68.31-72.15)	70.82±4.40 (67.86-73.77)	0.86
Weight (kg)	58.23±7.26 (55.22-61.35)	60.16±7.53 (54.77-65.55)	58.96±9.94 (46.62-71.30)	0.81
Height (cm)	158.24±9.55 (154.21-162.28)	154.05±6.39 (149.48-158.62)	160.08±9.00 (148.89-171.26)	0.36
BMI (kg/m^2)	23.96±2.80 (23.28-24.63)	24.70±2.99 (23.37-26.03)	24.44±3.41 (22.15-26.74)	0.55

Note: [a] Data are represented using mean±standard deviation (95% confidence interval) and compared using the one-way analysis of variance (ANOVA).

Table 2 Findings of the Thai-FRAT in each item (n=102)

Variable	Group			p-value
	Non-faller (n = 69)	Single-faller (n = 22)	Multiple-faller (n = 11)	
Total Thai-FRAT score[a]	2.09±1.25 (1.79-2.39)	2.90±1.66 (2.17-3.64)	7.73±1.62[†,‡] (6.64-8.81)	<0.001[*]
Item 1: Gender [female : male][b]	42 (60.87) : 27 (39.13)	13 (59.09) : 9 (40.91)	9 (81.82) : 2 (18.18)	0.38
Item 2: Visual impairment [yes : no][b]	29 (42.03) : 40 (57.97)	11 (50.00) : 11 (50.00)	5 (45.45) : 6 (54.55)	0.80
Item 3: Balance impairment [yes : no][b]	24 (34.78) : 45 (65.22)	15 (68.18) : 7 (31.82)	5 (45.45) : 6 (54.55)	0.02[*]
Item 4: Medication use [yes : no][b]	25 (36.23) : 44 (63.77)	9 (40.91) : 13 (59.09)	6 (54.55) : 5 (45.45)	0.50
Item 5: Fall history ≥ 2 fall [yes : no][b]	0 (0) : 69 (100)	0 (0) : 22 (100)	11 (100) : 0 (0)	<0.001[*]
Item 6: Thai style house [yes : no][b]	1 (1.45) : 68 (98.55)	1 (4.55) : 21 (95.45)	0 (0) : 11 (100)	0.58

Note: [a] Data are represented using mean±standard deviation (95% confidence interval) and compared using the one-way analysis of variance (ANOVA), [b] Data are represented using number of participants (%) and compared using the Chi-square test, [*] Indicates statistical significant difference, [†,‡] Indicate the group with significant differences from the indicated groups, where [†] is non-faller, and [‡] is single-faller.

Discussion and conclusions

This study investigated the ability of each Thai-FRAT's item for identifying risk of fall in elderly with and without history of fall. Therefore, the comparison of each item among non-faller, single-faller, and multiple-faller groups provided which item of the Thai-FRAT can be practically determined their fall risk. The results revealed significant differences of total Thai-FRAT's scores among groups ($p<0.001$, Table 2) in which multiple-faller had significant greater risk of fall (7.73±1.62 scores) than the others, whereas there were no significant differences between non-faller and single-faller groups (2.09±1.25 and 2.90±1.66 scores, $p>0.05$, Table 2). Furthermore, only the item 3 (balance impairment) and item 5 (a history of fall at least 2 times within the past 6 months) were significant differences among 3 groups ($p<0.05$ and $p<0.001$, respectively, Table 2).

The Thai-FRAT was a combination of qualitative (4 fall risk factors) and quantitative (tandem stand test and Snellen chart) tools which was commonly used due to high reliability and feasibility to apply in clinical and community setting (Thiamwong et al., 2008). However, the advancement of socioeconomic was a major cause of the

environment and living accommodation changes; thus, Thai style house (the first floor is 1.5 meter or higher from ground) with a traditional Thai stair style was rarely found in nowadays (Thiamwong et al., 2008). Therefore, the Thai style house was hardly found in present study (Table 2). Furthermore, female gender, visual impairment, and medication use factors were not significant differences among 3 groups ($p>0.05$, Table 2). That means all above 3 factors may have less involvement as risk of fall than balance impairment and history of fall factors. Similarly, Thiamwong et al. (2008), who developed the Thai-FRAT, rated only 1 score for female gender, visual impairment, and medication use factors. However, the participants' age in present study was around 70 years old which was actual frailty (Ruikes et al., 2016; Spaniolas et al., 2010). Although they were non-faller, the deterioration of body systems and functional ability gradually advanced with age.

Although the number of each faller group was unequal, there were no significant differences among the groups in terms of demographic data (Table 1). The findings showed that only multiple-faller group had total Thai-FRAT's scores more than 4 out of 11 scores (7.73±1.62 scores, Table 2). This confirmed that these individuals with recurrent falls (a history of two or more falls) within the past 6 months were indicated as fall risk factor. Furthermore, balance impairment (unable to take full tandem for 10 seconds) was one of another important fall risk factor in present study (Table 2). Even though, the multiple-faller was reported less percentage of balance impairment than single-faller (45.45% and 68.18%, respectively), it might occur due to more than a half of fall event in multiple-faller resulted from extrinsic factors such as slipping and tripping (14 events). The findings contrasted with previous studies which reported multiple falls commonly caused by intrinsic factor (Nevitt et al., 1989; Nickens, 1985; Toraman, Yildirim, 2010), whereas present study confirmed that multiple falls in frail elderly had a chance of both intrinsic and extrinsic factors. Moreover, evidence supported that the tandem stand test was effective item of the Berg Balance Scale to indicate risk of fall in elderly (Kim et al., 2017). Therefore, present study suggested that having history of two or more falls within the past 6 months and balance impairment (assessed by tandem stand test of less than 10 seconds) can be used as fall risk indicators in elderly. However, there were some limitations of the study. Firstly, the study recruited a small sample size, especially in faller group. Therefore, a further study should recruit greater number for clearer findings. Secondly, the data were cross-sectional collection in which it cannot identify cause-effect relationship of fall. A further prospective study may confirm the causal relationship of the findings.

Conclusions

Present study suggested that 2 items of the Thai-FRAT including history of two or more falls within the past 6 months and balance impairment using tandem stand test of less than 10 seconds can be used as fall risk indicator in elderly. Therefore, the health care officers can apply these 2 items to early screen fall risk in elderly with less time consuming, simple and inexpensive which it's useful to provide appropriate fall preventions and interventions.

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