

Original Research Article

The relationship between nutritional status and fall risk assessed by timed up and go test in elderly in the primary care network of Bang Kruai hospital: a cross-sectional study

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ABSTRACT

Background: Malnutrition and falling problems are common and important in older adults. The previous study found that malnutrition was associated with falling in older adults. Studies of the relationship between these two conditions are limited and there have been limited data about risk of malnutrition in primary care of Thailand, so we investigate the relationship of malnutrition, risk of malnutrition and risk of falling in older patients.

Methods: The study was cross-sectional analytic study of 224 participants aged 60 years or older who visited the primary care of Bang Kruai Hospital during February to March 2024. Face-to-face interview and test were conducted. The nutritional status was evaluated by using the mini nutritional assessment (MNA). The risk of falling was evaluated by time up and go test. The data were obtained for the prevalence using percentage values. The relationship was analysed by using multivariable logistic regression

Results: Among 224 patients with mean age 69.29 ± 6.44 years old, 64.29% of them were women. The prevalence of malnutrition and risk of malnutrition were 3.12 and 30.36%, respectively. The prevalence of risk of falling was 26.79%. This study showed that the malnutrition and risk of malnutrition were significantly associated with risk of falling (Adjusted OR 2.23, 95%CI 1.19-4.22, $p < 0.001$).

Conclusions: The malnutrition and risk of malnutrition were related with risk of falling. Therefore, when evaluating an older patient with risk of falling, nutritional status should be evaluated, or risk of falling should also be evaluated in an older patient with risk of malnutrition. Thus, the more comprehensive management of these two problems can be possible.

Keywords: Nutritional status, Risk of falling, Older adults, Time Up and Go test

INTRODUCTION

Since 2005, Thailand has officially entered an aging society. By 2022, elderly individuals accounted for 19% of the total population, and it is projected that Thailand will soon become a “complete aged society”.^{1,2} Aging is associated with physiological changes that increase the risk of nutritional deficiencies and impaired mobility.^{3,4}

Malnutrition is an important issue among the elderly worldwide. In the United Kingdom, 41% of individuals over 60 years old are at risk of malnutrition.⁵

Similarly, a study in Surin province, Thailand, found that 54.17% of elderly individuals in Lamduan district were malnourished.⁶ Malnutrition is considered one of the contributing factors to falls among the elderly.^{7,8}

The world health organization (WHO) estimates that 28-35% of individuals aged 65 years and older experience falls annually, with this rate increasing to 32-42% among those aged 70 years and older. Falls are recognized as a significant global public health issue, contributing to disability, long term care, and hospital admissions.^{9,10} According to the institute of geriatric medicine, 24.1% of elderly women and 12.1% of elderly men in urban Thailand reported experiencing a fall within the past six months.⁷ The consequences of falls range from disabilities to loss of independence and even mortality.⁷ Therefore, fall prevention in the elderly is a crucial aspect of healthcare.⁷

The 2021 Thai national guidelines for elderly health screening recommend using the timed up and go (TUG) test to assess fall risk and the MNA to evaluate nutritional status in primary care settings.¹¹

A review of the literature indicates that studies on the relationship between nutrition and fall risk have primarily focused on the association between malnutrition and falls, with limited research conducted in Thailand, particularly within the primary care setting.¹²⁻¹⁷ This study aims to evaluate the relationship between nutritional status and fall risk using the TUG test among elderly in the primary care network of Bang Kruai hospital. The findings will provide insights that may contribute to the development of preventive strategies for both falls and malnutrition among elderly individuals in primary healthcare settings.

Objective

Objective was to study the relationship between the risk of malnutrition and the risk of falls in the elderly.

METHODS

Research design was a cross-sectional study.

Population and sample

The population consists of elderly (aged 60 years and above) who seek services at the primary care network of Bang Kruai hospital, Bang Kruai district, Nonthaburi Province. The data on outpatient service usage from the fiscal year 2023 indicates 15,971 patients (Health data center, Nonthaburi provincial public health office, as of November 27, 2023).

The sample group consists of elderly individuals who received services at the primary care network of Bang Kruai Hospital between February 1, 2024, and March 31, 2024. The sample is selected using accidental sampling (n=225 individuals).

A pilot study was conducted to collect data on the nutritional status and fall risks in 30 elderly individuals receiving services at the primary care network of Bang

Kruai Hospital. The sample size was then calculated using a statistical program. For elderly individuals with normal nutritional status, the fall risk rate was $P_1=0.185$, while for those with malnutrition and at risk of malnutrition, the fall risk rate was $P_2=0.367$. The ratio of elderly individuals with malnutrition and at risk of malnutrition to those with normal nutritional status was $r=0.8$. A two-sided test with a significance level of 5% and a power of 80% was applied. Based on these parameters, a suitable sample size of 212 individuals was calculated. To account for incomplete data, a total of 224 individuals was selected. The sample size was calculated using the formula:

$$n_1 = \left[\frac{Z_1 - \alpha/2 \sqrt{\bar{p}\bar{q} \left(1 + \frac{1}{r}\right)} + Z_1 - \beta \sqrt{p_1 q_1 + \frac{p_2 q_2}{r}}}{\Delta} \right]^2$$

$$r = \frac{n_2}{n_1}, q_1 = 1 - p_1, q_2 = 1 - p_2$$

$$\bar{p} = p_1 + p_2 r / (1 + r), \bar{q} = 1 - \bar{p}$$

Inclusion criteria

Elderly individuals who can perform activities of daily living independently, assessed using the Barthel activities of daily living index with a score of 12 or higher, not bedridden, able to communicate in Thai, able to answer the questionnaire, and willing to sign consent to participate in the research were included.

Exclusion criteria

Incomplete questionnaires, individuals with psychiatric conditions, a history of medications affecting the nervous system, a history of diuretic use, chest pain, dizziness, joint or knee pain during physical activity, uncontrolled hypertension ($>160/100$ mmHg), hypotension ($\leq 90/60$ mmHg), or individuals who wish to withdraw from the study were excluded.

Definitions

TUG test

This is a tool that evaluates walking ability, muscle strength, movement, both static and dynamic balance. The test involves timing how long it takes for an elderly person to rise from a chair with armrests, walk a straight line of 3 meters, turn around, and return to sit in the same chair. Assistive walking devices may be used, but it should be recorded which type of device is used.^{7,11,18-20}

Fall risk

This refers to individuals who, when evaluated using the TUG test, take more than 13.5 seconds to complete the test.²⁹

Malnutrition

This refers to individuals who score between 0 and 7 on the MNA (short form), which has a maximum score of 14, or those who score less than 17 on the MNA (full form), which has a maximum score of 30.¹¹

Risk of malnutrition

This refers to individuals who score between 8 and 11 on the MNA (short form) out of 14, or those who score between 17 and 23.5 on the MNA (full form) out of 30.¹¹

Risk of malnutrition and malnutrition

This refers to both the risk of malnutrition and the condition of malnutrition.

Statistical analysis

Analysis will be conducted using the following methods:

Descriptive statistics: To analyze demographic characteristics, including categorical data, using frequency, percentage, mean, and standard deviation.

Chi-square test or Fisher exact test: To analyze the relationship between nutritional status and fall risk, with a significance level set at $p < 0.05$. Results will be presented as odds ratio coefficients (95% CI).

Multivariable logistic regression: To analyze the relationship between multiple variables, with a significance level set at $p < 0.05$. Results will be presented as odds ratio coefficients (95% CI).

Protection of participants' rights

All participants will be informed and asked for written consent before participating in the study. No personal identifying information will be recorded in the questionnaires. If participants are found to be at risk of falling or malnutrition after assessment, the researcher will coordinate for necessary treatment and referrals. This research has not received external funding.

The study was reviewed and approved by the human research ethics committee, Nonthaburi provincial public health office, on January 22, 2024, with project number 8/2567.

RESULTS

Demographic data

A total of 224 participants were included in the study, with 144 females (64.29%) and 80 males (35.71%). Among them, 60 participants were at risk of falling, including 16 males (26.67%) and 44 females (73.33%).

The average age of the participants was 69.29 years, with the fall-risk group having an average age of 72.13 years and the non-fall-risk group having an average age of 68.26 years. The average weight of the participants was 62.75 kg, with the fall-risk group averaging 62.79 kg and the non-fall-risk group averaging 62.73 kg. The average height was 1.58 meters, with the fall-risk group averaging 1.56 meters and the non-fall-risk group averaging 1.59 meters. The average BMI was 24.87 kg/m², with the fall-risk group averaging 25.5 kg/m² and the non-fall-risk group averaging 24.65 kg/m².

Nutritional status

149 participants were classified as having normal nutritional status, with 31 in the fall-risk group and 118 in the non-fall-risk group.

Risk of malnutrition

68 participants were at risk of malnutrition, including 24 in the fall-risk group and 44 in the non-fall-risk group.

Malnutrition

7 participants had malnutrition, with 5 in the fall-risk group and 2 in the non-fall-risk group.

Overall, the participants in both the fall-risk and non-fall-risk groups had similar age, weight, height, and BMI, as presented in the Table 1.

The relationship between malnutrition and risk of malnutrition with fall risk

The risk of malnutrition and malnutrition, as assessed using the MNA, is significantly associated with the risk of falling by full form (Table 2).

Factors associated with fall risk in elderly individuals receiving primary care services

Univariate analysis of factors from the MNA, age, and gender in relation to fall risk in elderly individuals revealed that age over 75 years, weight loss greater than 3 kg within the last 3 months, taking more than 3 medications per day, and calf circumference (CC) <31 cm were significantly associated with fall risk (Table 3).

Analyzing results by using multivariable logistic regression, it was found that age over 75 years had a statistically significant impact on fall risk. Elderly participants aged 75 years and above were 3.36 times more likely to be at risk of falling compared to those under 75 years (95% CI 1.67-6.78, $p < 0.01$). Additionally, participants who had lost more than 3 kg of weight in the past 3 months were 3.47 times more likely to be at risk of falling, which was statistically significant (95% CI=1.10-10.94, $p = 0.03$) (Table 3).

Table 1: Demographic data of the sample group (n=224).

General information	Risk of falling, n=60 (%)	No risk of falling, n=164 (%)	Total, n=224, (%)
Sex			
Male	16 (26.67)	64 (39.02)	80 (35.71)
female	44 (73.33)	100 (60.98)	144 (64.29)
Age (in years), mean±SD	72.13±7.70	68.26±5.55	69.29±6.44
Weight (in kg), mean±SD	62.79±15.86	62.73±12.76	62.75±13.67
Height (in m), mean±SD	1.56±0.10	1.59±0.09	1.58±0.09
BMI (kg/m²), mean±SD	25.5±4.98	24.65±4.05	24.87±4.33
Nutritional status (Full-form MNA)			
Normal	31 (51.67)	118 (71.95)	149 (66.52)
Risk of malnutrition	24 (40.00)	44 (26.83)	68 (30.36)
Malnutrition	5 (8.33)	2 (1.22)	7 (3.12)

Table 2: The relationship between malnutrition and risk of malnutrition with fall risk (n=224).

MNA		Risk of falling, (n=60)				
		N	Crude OR (95% CI)	P value	Adjusted OR* (95% CI)	P value
Short form	Risk of malnutrition and malnutrition	29	1.62 (0.85-3.08)	0.11	1.41 (0.75-2.64)	0.28
Full form	Risk of malnutrition and malnutrition	29	2.40 (1.24-4.61)	<0.01	2.23 (1.19-4.22)	<0.01

*Adjusted by age and sex.

Table 3: The relationship between various factors and fall risk.

Items	Fall risk status				
	N (%)	Univariable OR (95% CI)	P value	Adjusted OR** (95% CI)	P value
Age ≥75 year olds	23 (10.27)	3.55 (1.68-7.44)	<0.01	3.36 (1.67-6.78)	<0.01
Sex:female	44 (73.33)	1.76 (0.88-3.62)	0.09	1.61 (0.79-3.31)	0.19
MNA factor***					
A: Over the past 3 months, eating significantly less.	8 (42.11)	2.14 (0.70-7.19)	0.16		
B: In the past 3 months, lost more than 3 kilograms.	11 (64.71)	5.91 (1.87-20.32)	<0.01	3.47 (1.10-10.94)	0.03
D: In the past 3 months, had severe stress or an acute illness	19 (38.78)	2.07 (0.99-4.25)	0.03	1.74 (0.80-3.77)	0.16
E: Have mental problems	32 (29.91)	1.36 (0.72-2.57)	0.31		
F: BMI>23 kg/m ²	20 (26.67)	0.99 (0.50-1.93)	0.98		
H: Taking >3 types of medication per day	39 (33.62)	2.10 (1.09-4.09)	0.02	2.00 (1.00-4.00)	0.051
J: Eat <3 meals a day	33 (31.73)	1.60 (0.85-3.04)	0.12		
K: Don't eat protein-rich foods every day	48 (26.82)	1.01 (0.46-2.32)	0.98		
L: Eat vegetables and fruits <2 servings/day.	31 (29.25)	1.27 (0.67-2.40)	0.43		
M: Drink <3 cups/day	16 (27.12)	1.02 (0.49-2.08)	0.95		
O: Patients believe they are malnourished	27 (35.53)	1.92 (0.99-3.68)	0.03	1.39 (0.69-2.81)	0.36
P: Compared to people of the same age, patients think that their own health is better.	33 (32.04)	1.64 (0.87-3.11)	0.1		
Q: Arm circumference (MAC) <21 cm	4 (36.36)	1.60 (0.33-6.57)	0.46		
R: Calf circumference (CC) <31 cm	10 (52.63)	3.44 (1.18-10.11)	0.01	1.47 (0.45-4.80)	0.52

Adjusted by age, sex and covariate that p<0.05, * C,G,I,N based on the inclusion criteria.

DISCUSSION

Elderly individuals who received services at the primary healthcare network of Bang Kruai hospital had a prevalence of the malnutrition at 3.12%, at risk for the malnutrition at 30.36%, and normal nutrition status at 66.52%. Previous studies have reported that the prevalence of malnutrition varies by region, context, and the indicators used, with values ranging from 1.31% to 47.8%.²¹⁻²⁷

The relationship between nutrition status and the risk of falls, assessed by the time up and go test in elderly individuals at the Bang Kruai hospital primary healthcare network, showed that the risk of malnutrition and malnutrition, as assessed by the MNA short form and full form, was significantly associated with the risk of falls (Short form MNA: Adjusted OR 1.41, 95% CI: 0.75-2.64, $p=0.28$) (Full form MNA: Adjusted OR 2.23, 95% CI: 1.19-4.22, $p<0.01$), which is consistent with previous studies.^{12,17} Therefore, individuals at risk of malnutrition are also associated with an increased risk of falling.

From the study of factors such as age, sex, and data from the MNA related to the risk of falls in elderly individuals, the analysis revealed that those aged 75 years and above (Adjusted OR 3.36, 95% CI: 1.67-6.78) and those who lost more than 3 kg in weight in the past 3 months (Adjusted OR 3.47, 95% CI: 1.10-10.94) were significantly associated with an increased risk of falling.

Elderly individuals aged 75 and above were found to be at greater risk of falling, which is consistent with previous reports of increased fall incidents with age.^{6,11,22} As people age, physical changes such as vision, muscle strength, balance, and gait contribute to increased internal factors that promote the risk of falls among the elderly.

The factor of losing more than 3 kg of weight in the past 3 months was also associated with a higher risk of falling, which aligns with prior studies indicating that weight loss can increase the likelihood of falls.²⁹ However, factors such as eating much less in the past 3 months, eating fewer than 3 meals a day, not consuming protein daily, eating fewer than 2 servings of vegetables and fruits a day, and drinking fewer than 3 cups of beverages daily, which indicate poor eating habits, did not show a significant relationship with the risk of falls. Therefore, when elderly individuals are screened for malnutrition using the MNA and experience a weight loss of more than 3 kg in the past 3 months, they are at increased risk of falling.

Research on the relationship between nutrition status and the risk of falls is still limited. This study is one of the few in Thailand to study relationship between nutrition status and the risk of falls assessed by the time up and go test in elderly individuals within a primary care context.

However, this study was a cross-sectional study, which limits the ability to establish causal relationships. It also did not perform a detailed nutritional assessment, such as blood tests, due to the constraints of the primary care context, which focuses on screening. Therefore, future studies may explore this further and follow up over a longer period.

Strengths

The study's strength lies in the selection of participants and data collection. The participants were from a primary healthcare service setting, aligning with the context of malnutrition and fall risk screening for the elderly. Participants were highly cooperative, which enabled the collection of comprehensive data. The data collection through face-to-face interviews and the use of the time up and go test for fall risk assessment contributed to greater accuracy. Additionally, the researchers who collected, recorded, and analyzed the data were separate individuals, helping to reduce information bias.

Limitations

The study's cross-sectional design limits the ability to draw conclusions about changes over time or cause-and-effect relationships. Some of the data was retrospective, which could introduce recall bias. Furthermore, most of the data were self-reported, which may lead to reporting errors, and the exact timing of the factors studied is unclear.

CONCLUSION

This study found a significant relationship between the risk of malnutrition, malnutrition status, and the risk of falls in the elderly. Therefore, when an elderly individual is identified as being at risk for malnutrition or malnourished, the risk of falling should also be assessed. Conversely, if an individual is at risk for falling, a nutritional assessment should be conducted to provide comprehensive care for the elderly.

Factors associated with an increased risk of falling in the elderly include being 75 years or older and losing more than 3 kg in the past 3 months, which increases the risk of falling by up to 3 times. Therefore, it is important to assess fall risk and focus on educating elderly individuals aged 75 years and above and those who have lost more than 3 kg in weight in past 3 months on fall prevention.

As this study is cross-sectional and cannot explain changes in variables or establish causal relationships, a cohort study should be conducted to reduce this bias. Data should also be collected from different areas and over longer periods to increase data diversity, ensuring better representation of the elderly population. Future research could also explore the long-term impact of improving malnutrition or preventing malnutrition on reducing the risk of falls.

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