PREVALENCE AND ASSOCIATED FACTORS OF MALNUTRITION AMONG ELDERLY PATIENTS AT AN OUTPATIENT CLINIC, COMMUNITY HOSPITAL IN THAILAND: A CROSS-SECTIONAL STUDY

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Abstract

Background: The number of Thais aged 60 and older has increased dramatically, and this trend will continue, making Thailand an increasingly aging society in the coming decades. The nutritional state of the elderly should be a major priority because it harms mortality and quality of life.

Methods: From August to September 2022, the prevalence and associated determinants of malnutrition were determined based on a survey and hospital records using the Mini Nutritional Assessment (MNA®) as a screening tool for malnutrition among the elderly attending the outpatient department at Bangkhla Hospital. Multinomial regression analysis accounted for any confounding factors yielding an adjusted odds ratio (aOR) and 95% confidence intervals (95%CI).

Results: This study enrolled a total of 91 individuals. Of these, 4.40% (95%CI= 0.01-0.11) of the participants were malnourished, while 18.70% (95%CI=0.11-0.28) were at risk of malnutrition. After controlling for potential confounding factors, a history of Covid-19 was associated with malnutrition (aOR=55.00, 95%CI= 2.70 to 1110.30), cancer (aOR= 25.80, 95%CI= 1.60-409.40) and gouty arthritis (aOR= 8.80, 95%CI= 1.20-59.60) was similarly associated with at risk of malnutrition. However, the protective effect of exercise was associated with malnutrition and risk of malnutrition, respectively (aOR= 0.04, 0.13, 95%CI= 0.00-0.80, 0.00-0.50).

Conclusion: Overall, the study emphasized the significance of addressing malnutrition which was on the rise among the elderly in community hospitals in Thailand, especially in light of the aging population. Health professionals and policymakers should be aware of the various factors associated with malnutrition and strive to implement appropriate interventions to improve the nutritional status and quality of life of the elderly.

Keywords: Malnutrition, Gouty arthritis, Cancer, History of Covid-19, Elderly, Outpatient, Thailand

J Southeast Asian Med Res 2023: 7:e0167
https://doi.org/10.55374/jseamed.v7.167

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Received: 5 April 2023
Revised: 5 May 2023
Accepted: 9 May 2023

Introduction

The aging population has been increasing rapidly, especially among developing countries. It has been anticipated there will be an additional 1.4 billion elderly people by 2030 and 2.1 billion by 2050. According to the Institute for Economic Research on ASEAN and East Asia (ERIA), the percentage of people aged 60 and older could reach two thirds by 2040.[1] In 2020, Thailand's elderly population was projected to be 12 million or 18.3% of the entire population, or 1 in 5 individuals, six times the ratio in the prior 50 years.[2] Consequently, Thailand, possesses the fastest rate of population aging and addressing the health requirements of the elderly is one of the country's top policy priorities. Various factors influence the health of the elderly, yet nutrition remains disregarded. [3]

Malnutrition is used to characterize the situations of undernutrition, overnutrition and nutritional imbalance contributing to body dysfunction and negative clinical consequences, despite the lack of a precise definition of its etiology.[4] there is no universal agreement about its definition, prevalence, or method of identification and report. Fifteen definitions of malnutrition were critically examined to assess their variability. They ranged from descriptions of undernutrition alone to under- and overnutrition, with intakes ranging from dietary protein and energy alone to dietary and nondietary sources of all nutrients and energy. Definitions also varied from non-outcome based to those based on functional, physiological, and/or clinical outcomes. Some definitions relied on the pathways by which malnutrition develops, with one apparently requiring loss of fat-free mass. Also examined were nutrition screening tools, diversely developed for detection of malnutrition, management of malnutrition, and prediction of clinical outcomes or health care usage. Their intended use also varied from specific care settings (hospital, community, care homes Despite this, malnutrition was associated with several consequences including impaired immunity, an increased risk of falling and a deterioration in physical and cognitive performance. Furthermore, immune insufficiency may heighten illness severity, complications, recovery time and susceptibility to infections including the quality of life and the mortality rate.[5,6] there is no universal agreement about its definition, prevalence, or method of identification and report. Fifteen definitions of malnutrition were critically examined to assess their variability. They ranged from descriptions of undernutrition alone to under- and overnutrition, with intakes ranging from dietary protein and energy alone to dietary and nondietary sources of all nutrients and energy. Definitions also varied from non-outcome based to those based on functional, physiological, and/or clinical outcomes. Some definitions relied on the pathways by which malnutrition develops, with one apparently requiring loss of fat-free mass. Also examined were nutrition screening tools, diversely developed for detection of malnutrition, management of malnutrition, and prediction of clinical outcomes or health care usage. Their intended use also varied from specific care settings (hospital, community, care homes This ailment also impairs the elderly's physical and cognitive performance, resulting in hospitalization and additional expenses.[7,8] there is no universal agreement about its definition, prevalence, or method of identification and report. Fifteen definitions of malnutrition were critically examined to assess their variability. They ranged from descriptions of undernutrition alone to under- and overnutrition, with intakes ranging from dietary protein and energy alone to dietary and nondietary sources of all nutrients and energy. Definitions also varied from non-outcome based to those based on functional, physiological, and/or clinical outcomes. Some definitions relied on the pathways by which malnutrition develops, with one apparently requiring loss of fat-free mass. Also examined were nutrition screening tools, diversely developed for detection of malnutrition, management of malnutrition, and prediction of clinical outcomes or health care usage. Their intended use also varied from specific care settings (hospital, community, care homes In Thailand, the prevalence of malnutrition among the elderly ranged from 6 to 10%, while the prevalence among hospitalized elderly ranged from 40 to 70%. [9] Studies reported

that the prevalence of malnutrition in community-dwelling settings or geriatric outpatient clinics was approximately 20 and 30%, respectively. [10, 11] In addition, malnutrition and risk of malnutrition among patients at outpatient clinics and tertiary care hospitals in Thailand were 8 and 35%, respectively.[12] Even though multiple studies have investigated elderly malnutrition, a lack of information remains noted at community hospitals where primary health care was provided in Thailand. [13-17] This study aimed to determine the prevalence and associated factors of malnutrition among elderly patients at an outpatient clinic in a community hospital, illustrative of the rural community concerns in Thailand.

Methods

Study design and subjects

This cross-sectional study was conducted in August and September 2022 at Bangkhla Hospital, Chachoengsao Province, central Thailand. Patients over 60 who could make decisions freely and visited outpatient clinics were included in the study. Those who could not make judgments due to physical or mental incapacity and those who refused to participate were excluded. Participants who expressed discomfort while answering questions or being measured during the interview were excluded from the study. In addition, their arm and calf circumferences, body weight and height were measured. This study was approved by the Institutional Review Board of the Medical Department of the Royal Thai Army (IRBRTA): M019q/65.

Data collection and measurements

A computerized search of medical records was conducted to identify potential participants. Before performing the investigation, informed consent was obtained. If a participant could not read the information sheet, a research team member would read the information to them, after which they would use their fingerprint to affirm their agreement with the consent form. To obtain information from geriatric patients, face-to-face interviews using standardized questionnaires were conducted by well-trained interviewers.

The standardized questionnaire included demographic characteristics (sex, age, nationality, healthcare coverage scheme, religion, occupation, education level and monthly family income) as well as comorbidities (allergy/asthma, gouty arthritis, diabetes mellitus, dyslipidemia, thalassemia/anemia, hypertension, chronic kidney disease, all types of cancer history, disability status, Chronic Obstructive Pulmonary Disease (COPD), heart disease, thyroid disorder and history of COVID-19) which were defined based on the recorded International Classification of Diseases 10th Revision (ICD-10). In addition, current medications (antihypertensives, statins, heart failure medication, thyroid medication and antidepressants) were recorded, as well as lifestyle (living alone, living with family and exercise status obtained rom the face-to-face interview) and dietary preferences (eating habits in the previous three months, homemade or purchased food and nutrition supplements), and the MNA® questionnaire. According to the ICD-10, participants with abnormalities of the thyroid gland function or structure and symptoms related to elevated or decreased plasma concentrations of thyroid hormone (hyperthyroidism or hypothyroidism, respectively) were considered to have a thyroid disorder.

The well-trained research teams evaluated the anthropometric measurements. The participant's weight and height were determined using a mechanical scale and a stadiometer according to the Centers for Disease Control and Prevention (CDC) instructions with two decimals measurements. [18] Arm circumference was determined by placing a measuring tape at the midpoint of the acromion and olecranon processes on the shoulder blade and ulna.[19] Calf circumference measurements were taken with participants seated with their knees bent at a 90-degree angle,[20] and arm and leg circumferences were measured to one decimal place. The participant's body weight was measured in kilograms and the height in centimeters. BMI was calculated as body weight in kilograms divided by height in weight (kg)/height $(m)^2$. BMI was calculated as body weight in kilograms divided by height in meters squared (kg/m^2). BMI scores were

classified in four groups, including<18.5 kg/m^2 (underweight), 18.5 to 24.9 kg/m^2 (normal range), 25.0 to 29.9 kg/m^2 (overweight) and 30.0 kg/m^2 (obese).[21]

Nutritional status definition

This study used the Mini Nutritional Assessment (MNA®) as a screening tool for malnutrition, consisting of six screening questions and twelve nutritional questions. Patients scoring 24.0 or more were defined as having a normal nutritional status, and those scoring 17.0 to 23.5 (scoring system ends withone1 a decimal of 0 or 5) were at risk of malnutrition while those scoring <17.0 were malnourished. In addition, the summation of n malnutrition (MNA® <17.0) and at risk of malnutrition (MNA® 17.0 to 23.5) was defined as the overall risk of malnutrition.[22]

Sample size and statistical analysis

The sample size was determined using the n4studies Software (Version 1.4.1) and the formula for infinite population proportion, derived from data on malnutrition prevalence in Thailand from a related study.[9] side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc.

The data were analyzed using IBM Corp. Released in 2017. IBM SPSS Statistics for Windows, Version 25.0. (Armonk, NY: IBM Corp.). A number and a percentage represented the categorical information, whereas the continuous variable was represented by means and standard deviation (SD). The Chi-square test was used to compare the frequency distribution of categorical variables across strata. Using the Kolmogorov-Smirnov test, the normality of the continuous data was determined. Student's t-test was applied to compare continuous, normally distributed data. The prevalence was examined using descriptive statistics and provided as a percentage and a 95% confidence interval (CI). Independent variables were established using univariable and multivariable binary and multinomial logistic regression analyses. The overall risk of malnutrition was analyzed using binary logistic regression while. In contrast, nomial logistic regression was used to analyze the associated factors between malnutrition and normal groups and at risk of malnutrition and normal groups. Factors showing p<0.2 in the unadjusted analysis were entered in the multivariable analysis of binary logistic regression and multinomial logistic regression analyses.

Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were then reported, and p<0.05 was considered statistically significant.

Results

As shown in **Figure 1**, 105 individuals were screened for study participation. Seven were excluded due to physical impairment and having legal representatives, two declined participation, and five were excluded due to mental impairment (two psychiatric problems and three Alzheimer's disease diagnoses, respectively). Thus, 91 individuals enlisted in the study, and each participant completed the questionnaire, anthropometric measurement, MNA® nutritional status and hospital database ICD-10 recording.

The baseline characteristics of the individuals are shown in **Table 1**. The average age of participants was 70.50 ± 6.90 years, 40.70% were male, and most participants were Thai and Buddhist. Of these, 85.71% had Universal Health Coverage Scheme, and 14.29% had Civil Servant Medical Benefit Scheme. Body mass index (BMI) categorized 29.70% as pre-obese (25.00 to 29.90 kg/m^2), 28.60% were normal weight (BMI 18.50 to 22.90 kg/m^2), 24.20% were overweight (BMI 23.00 to 24.90 kg/m^2), 11% were obese (BMI ≥30.00 kg/m^2) and 6.60% were underweight (BMI <18.50 kg/m^2).

The MNA® screening revealed that 4.40% (95%CI: 0.01-0.11) of the participants were malnourished and 18.70% (95%CI=0.11-0.28) were at risk for malnutrition. As shown in **Table 2**, the overall risk of malnutrition was 23.10% (95%CI=0.15-0.33).

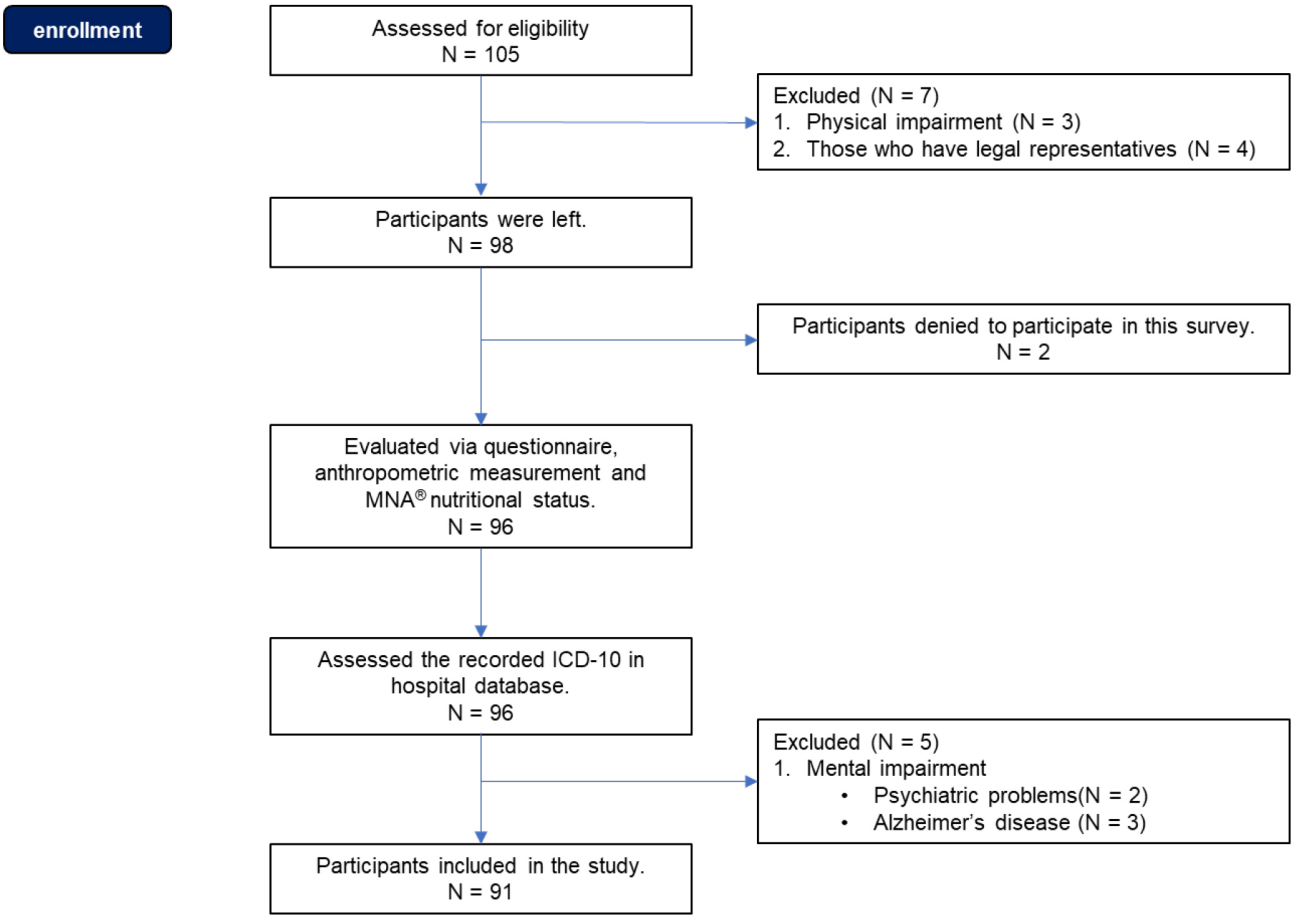

Figure 1. Flow diagram depicting the design of the cross-sectional study conducted among elderly patients at an outpatient clinic, a community hospital in Thailand.

Table 3 shows the differentials of nutritional status by participants' background characteristics and univariable binary analysis, consequently with multivariable binary analysis of potentially associated factors. The findings indicated only three factors, i.e., exercise (Adjusted Odds ratio (AOR)= 0.10, 95%CI= 0.00- 0.40), all types of cancer (aOR= 27.50, 95%CI=1.40-521.60) and history of COVID-19 (aOR= 14.30, 95% CI= 1.90-106.80), were significantly associated with malnutrition.

Table 4 shows multivariable multinomial logistic analysis revealing that after adjusting confounding factors, history of COVID-19 had an association with malnutrition (aOR= 55.00, 95% CI= 2.70-1110.30), cancer (aOR= 25.80, 95% CI=1.60 -409.40) and gouty arthritis (aOR= 8.80, 95%CI= 1.20-59.60) was also associated with the group at risk of malnutrition. In addition, the protective effect of exercise was associated with malnutrition and risk of malnutrition, respectively (aOR=0.04, 0.13, 95%CI=0.00-0.80, 0.00-0.50).

Discussion

Although the prevalence of malnutrition among the elderly identified in this study agreed with a related study of hospitalized elderly patients,[23] i.e., 4.4% and 6.1%, respectively, the total population was limited and did not include bedridden and other patients unable to visit hospitals which could have affected the accuracy of malnutrition prevalence. The prevalence of the at risk of malnutrition group was 18.7%. However, in this study, the prevalence was lower in both malnutrition and at risk of malnutrition groups compared with the that of participants in tertiary care hospitals, which were more complex than those in community hospitals.[1]

Table 1. Demographic characteristics of elderly patients at an outpatient clinic, community hospital in Thailand

Characteristic	Total	Nutritional status assessed by MNA® Overall risk of malnutrition (N = 21)		*p*-value
		Malnutrition	At risk of Malnutrition	
	N = 91	N = 4	N = 17	
	N (%)	N (%)	N (%)	
Sex				0.112
Male	37 (40.66)	0 (0.00)	5 (13.51)	
Female	54 (59.34)	4 (7.41)	12 (22.22)	
Age (years)				0.262
Mean ± SD	70.54 ± 6.89	67.50 ± 8.06	72.24 ± 7.31	
Min - Max	60 - 94	61 - 79	62 - 88	
60-69	46 (50.55)	3 (6.52)	7 (15.22)	
70-79	36 (39.56)	1 (2.78)	6 (16.67)	
≥80	9 (9.89)	0 (0.00)	4 (44.44)	
Nationality				0.859
Thai	90 (98.90)	4 (4.44)	17 (18.89)	
NonThai	1 (1.10)	0 (0.00)	0 (0.00)	
Health coverage scheme				0.662
Universal Health coverage	78 (85.71)	4 (5.13)	14 (17.95)	
Civil Servant Medical Benefit Scheme	13 (14.29)	0 (0.00)	3 (23.08)	
Religion				0.736
Buddhist	89 (97.80)	4 (4.49)	17 (19.1)	
Other	2 (2.20)	0 (0.00)	0 (0.00)	
Occupation				0.209
Unemployed	54 (59.34)	3 (5.56)	14 (25.93)	

Table 1. Demographic characteristics of elderly patients at an outpatient clinic, community hospital in Thailand (Cont.)

Characteristic	Total	Nutritional status assessed by MNA® Overall risk of malnutrition (N = 21)		*p*-value
		Malnutrition	At risk of Malnutrition	
	N = 91	N = 4	N = 17	
	N (%)	N (%)	N (%)	
Agriculture	23 (25.27)	0 (0.00)	1 (4.35)	
Employee	11 (12.09)	1 (9.09)	1 (9.09)	
Merchant or personal business	3 (3.30)	0 (0.00)	1 (33.33)	
Education level				0.808
Illiterate	2 (2.20)	0 (0.00)	1 (50.00)	
Primary school	74 (81.32)	4 (5.41)	15 (20.27)	
Secondary school	7 (7.69)	0 (0.00)	1 (14.29)	
Vocational degree	5 (5.49)	0 (0.00)	0 (0.00)	
Bachelor's degree	3 (3.3)	0 (0.00)	0 (0.00)	
Monthly family income (THB)				0.064
≤1000	18 (19.78)	3 (16.67)	3 (16.67)	
1001-5000	36 (39.56)	1 (2.78)	8 (22.22)	
≥ 5001	37 (40.66)	0 (0.00)	6 (16.22)	
Smoking history				0.53
No	10 (10.99)	1 (10.00)	1 (10.00)	
Yes	81 (89.01)	3 (3.70)	16 (19.75)	
Alcohol consumption history				0.707
No	8 (8.79)	0 (0.00)	1 (12.50)	
Yes	83 (91.21)	4 (4.82)	16 (19.28)	

Table 1. Demographic characteristics of elderly patients at an outpatient clinic, community hospital in Thailand (Cont.)

Characteristic	Total	Nutritional status assessed by MNA® Overall risk of malnutrition (N = 21)		*p*-value
		Malnutrition	At risk of Malnutrition	
	N = 91	N = 4	N = 17	
	N (%)	N (%)	N (%)	
BMI (kg/m²)				0.039
Mean ± SD	24.68 ± 4.28	18.39 ± 0.81	24.18 ± 4.03	
Min - Max	15.57 - 39.29	17.60 - 19.15	15.57 - 32.05	
<18.50 (Underweight)	6 (6.59)	2 (33.33)	1 (16.67)	
18.50-22.90 (Normal weight)	26 (28.57)	2 (7.69)	6 (23.08)	
23.00-24.90 (Overweight)	22 (24.18)	0 (0.00)	4 (18.18)	
25.00-29.90 (Pre-obesity)	27 (29.67)	0 (0.00)	4 (14.81)	
≥30.00 (Obesity)	10 (10.99)	0 (0.00)	2 (20.00)	
Comorbidity				
Hypertension	60 (65.93)	3 (5.00)	14 (23.33)	0.244
Dyslipidemia	58 (63.74)	3 (5.17)	11 (18.97)	0.883
Diabetes mellitus	32 (35.16)	1 (3.13)	6 (18.75)	0.909
Chronic kidney disease	11 (12.09)	0 (0.00)	5 (45.45)	0.046*
Heart disease	9 (9.89)	0 (0.00)	1 (11.11)	0.628
Gouty arthritis	8 (8.79)	0 (0.00)	4 (50.00)	0.055
COPD	7 (7.69)	0 (0.00)	2 (28.57)	0.684
Thyroid disorder	5 (5.49)	0 (0.00)	2 (40.00)	0.424
Allergy/asthma	4 (4.40)	0 (0.00)	2 (50.00)	0.25
All types of cancer history	4 (4.40)	0 (0.00)	3 (75.00)	0.013*
Disability	2 (2.20)	0 (0.00)	0 (0.00)	0.736
Thalassemia/anemia	2 (2.20)	0 (0.00)	2 (100.00)	0.012*

Table 1. Demographic characteristics of elderly patients at an outpatient clinic, community hospital in Thailand (Cont.)

Characteristic	Total	Nutritional status assessed by MNA® Overall risk of malnutrition (N = 21)		*p*-value
		Malnutrition	At risk of Malnutrition	
	N = 91	N = 4	N = 17	
	N (%)	N (%)	N (%)	
History of COVID-19				0.009*
No	83 (91.21)	2 (2.41)	15 (18.07)	
Yes	8 (8.79)	2 (25.00)	2 (25.00)	
Medication affecting appetite loss				
Statins	6 (6.59)	0 (0.00)	2 (33.33)	0.575
Heart failure medication	15 (16.48)	0 (0.00)	4 (26.67)	0.489
Tricyclic Antidepressants	5 (5.49)	1 (20.00)	3 (60.00)	0.007*

SD; Standard deviation, BMI; Body mass index, kg/m²; kilogram per meter square, COPD; Chronic Obstructive Pulmonary Disease

[a]Level of significant: *$p < 0.05$

Table 2. Prevalence of nutritional status among elderly patients at an outpatient clinic, community hospital in Thailand

Characteristic	N (%)	95%CI
At risk of malnutrition	17 (18.70)	0.11 to 0.28
Malnutrition	4 (4.40)	0.01 to 0.11

CI= confident inte

Table 3. Univariable and multivariable binary logistic regression analysis to assess relationships between associated factors and overall risk of malnutrition among elderly patients at an outpatient clinic, community hospital in Thailand

Characteristic	Nutritional status assessed by MNA®		Crude ORs (95% CI)	Adjusted ORs (95% CI)
	Normal nutrition N = 70 N (%)	Overall risk of malnutrition N = 21 N (%)		
Sex				
Male	32 (86.50)	5 (13.50)	1	
Female	38 (70.40)	16 (29.60)	2.70 (0.80-8.10)	
Age (years)				
Mean ± SD	70.00 ± 7.00	71.00 ± 7.00	1.02 (0.90-1.00)	
<70	36 (78.30)	10 (21.70)	1	
≥70	34 (75.60)	11 (24.40)	1.20 (0.40-3.00)	
Monthly family income (THB)				
≤1000	12 (66.70)	6 (33.30)	2.60 (0.60-9.60)	
1001-5000	27 (75.00)	9 (25.00)	1.70 (0.50-5.40)	
≥5001	31 (83.80)	6 (16.20)	1	
Living				
Living alone	7 (70.00)	3 (30.00)	1.50 (0.30-6.30)	
Living with family	63 (77.80)	18 (22.20)	1	
Eating habit in the past 3 months				
Homemade	64 (77.10)	19 (22.90)	0.90 (0.10-4.70)	
Purchased	6 (75.00)	2 (25.00)	1	
Nutrition supplements				
No	52 (76.50)	16 (23.50)	1	
Yes	18 (78.30)	5 (21.70)	0.90 (0.20-2.80)	

Table 3. Univariable and multivariable binary logistic regression analysis to assess relationships between associated factors and overall risk of malnutrition among elderly patients at an outpatient clinic, community hospital in Thailand (Cont.)

Characteristic	Nutritional status assessed by MNA®		Crude ORs (95% CI)	Adjusted ORs (95% CI)
	Normal nutrition N = 70 N (%)	Overall risk of malnutrition N = 21 N (%)		
Exercise				
No	19 (57.60)	14 (42.40)	1	1
Yes	51 (87.90)	7 (12.10)	0.20** (0.00-0.50)	0.10** (0.00-0.40)
Duration of exercise				
<30 minutes/day	14 (73.70)	5 (26.30)	1	
≥30 minutes/day	34 (94.40)	2 (5.60)	0.17* (0.00-0.90)	
Smoking history				
No	62 (76.50)	19 (23.50)	1	
Yes	8 (80.00)	2 (20.00)	0.80 (0.10-4.10)	
Alcohol consumption history				
No	63 (75.90)	20 (24.10)	1	
Yes	7 (87.50)	1 (12.50)	0.50 (0.00-3.80)	
History of falls in the previous year				
No	64 (77.10)	19 (22.90)	1	
Yes	6 (75.00)	2 (25.00)	1.10 (0.20-6.00)	
Allergy/asthma				
No	68 (78.20)	19 (21.80)	1	
Yes	2 (50.00)	2 (50.00)	3.60 (0.40-27.10)	
Gouty arthritis				
No	66 (79.50)	17 (20.50)	1	1
Yes	4 (50.00)	4 (50.00)	3.90 (0.80-17.10)	4.20 (0.50-33.30)

Table 3. Univariable and multivariable binary logistic regression analysis to assess relationships between associated factors and overall risk of malnutrition among elderly patients at an outpatient clinic, community hospital in Thailand (Cont.)

Characteristic	Nutritional status assessed by MNA®		Crude ORs (95% CI)	Adjusted ORs (95% CI)
	Normal nutrition N = 70 N (%)	Overall risk of malnutrition N = 21 N (%)		
Diabetes mellitus				
No	45 (76.30)	14 (23.70)	1	
Yes	25 (78.10)	7 (21.90)	0.90 (0.30-2.50)	
Dyslipidemia				
No	26 (78.80)	7 (21.20)	1	
Yes	44 (75.90)	14 (24.10)	1.20 (0.40-3.30)	
Hypertension				
No	27 (87.10)	4 (12.90)	1	
Yes	43 (71.70)	17 (28.30)	2.70 (0.80-8.70)	
Chronic kidney disease				
No	64 (80.00)	16 (20.00)	1	1
Yes	6 (54.50)	5 (45.50)	3.30 (0.90-12.30)	2.10 (0.30-12.90)
All types of cancer history				
No	69 (79.30)	18 (20.70)	1	1
Yes	1 (25.00)	3 (75.00)	11.50* (1.10-117.20)	27.50* (1.40-521.60)
COPD				
No	65 (77.40)	19 (22.60)	1	
Yes	5 (71.40)	2 (28.60)	1.30 (0.20-7.60)	
Heart disease				
No	62 (75.60)	20 (24.40)	1	
Yes	8 (88.90)	1 (11.10)	0.40 (0.00-3.20)	

Table 3. Univariable and multivariable binary logistic regression analysis to assess relationships between associated factors and overall risk of malnutrition among elderly patients at an outpatient clinic, community hospital in Thailand (Cont.)

Characteristic	Nutritional status assessed by MNA®		Crude ORs (95% CI)	Adjusted ORs (95% CI)
	Normal nutrition N = 70 N (%)	Overall risk of malnutrition N = 21 N (%)		
Thyroid disorder				
No	67 (77.90)	19 (22.10)	1	
Yes	3 (60.00)	2 (40.00)	2.40 (0.30-15.10)	
History of COVID-19				
No	66 (79.50)	17 (20.50)	1	1
Yes	4 (50.00)	4 (50.00)	3.90 (0.80-17.10)	14.30* (1.90-106.80)
Statins (atorvastatin)				
No	66 (77.60)	19 (22.40)	1	
Yes	4 (66.70)	2 (33.30)	1.70 (0.20-10.20)	
Heart failure medication (ACEI)				
No	59 (77.60)	17 (22.40)	1	
Yes	11 (73.30)	4 (26.70)	1.30 (0.30-4.40)	
Tricyclic Antidepressants				
No	69 (80.20)	17 (19.80)	1	1
Yes	1 (20.00)	4 (80.00)	16.20* (1.70-154.70)	11.30 (0.50-235.30)

COPD; Chronic Obstructive Pulmonary Disease, ACEI; Angiotensin-converting-enzyme inhibitors, MNA®; Mini Nutritional Assessment®, ORs; odds ratio, CI; confident interval, SD; Standard deviation

Level of significant: $^{**}p < 0.01$, $^{*}p < 0.05$

Multivariable binary logistic regression analysis (Enter): adjusted for exercise, gouty arthritis, chronic kidney disease, all types of cancer history, history of COVID-19, tricyclic antidepressants

Table 4. Univariable and multivariable multinomial logistic regression analysis of potentially associated factors of malnutrition and at risk of malnutrition among elderly patients at an outpatient clinic, community hospital in Thailand

Variable	Malnutrition Versus Normal nutrition				At risk of Malnutrition Versus Normal nutrition			
	Crude		Adjust-		Crude		Adjusted	
	ORs	95% CI	ed ORs	95% CI	ORs	95% CI	ORs	95% CI
Exercise								
No	1		1		1		1	
Yes	0.10	0.00-1.20	0.04*	0.00-0.80	0.20**	0.00-0.60	0.13**	0.00-0.50
Gouty arthritis								
No	NA				1		1	
Yes					5.10*	1.10-22.90	8.80*	1.20-59.60
All types of cancer history								
No	NA				1		1	
Yes					14.80*	1.40-152.70	25.80*	1.60-409.40
History of COVID-19								
No	1		1		1		1	
Yes	16.50*	1.80-149.50	55.00**	2.70-1110.30	2.20	0.30-13.10	7.60	0.90-62.00

NA; cannot be analyzed due to lacking an event in malnutrition and/or at risk of malnutrition and/or normal nutrition group

ORs; odds ratio, CI; confident interval

Level of significant: $^{**}p < 0.01$, $^{*}p < .05$

Pseudo R^2: 0.29

Log Likelihood: Chi-Square 30.69, df 8, p<0.001

In addition, after adjusting for confounding variables, the results indicated that patients who exercised were adversely associated with malnutrition and at risk of malnutrition. This occurred due to the adaptation processes induced by exercise, leading to total and peripheral nitrogen storage and enhanced muscle anabolism among the elderly.[24, 25] Regular exercise, especially the resistance training program, promotes muscle anabolism and protein metabolism and decreases sarcopenia and malnutrition risk.[26] muscle strength, and muscle performance in older people with sarcopenia. Methods: All randomized controlled trials on the effects of resistance training on outcome variables in older people with sarcopenia were searched on Pubmed, Embase, Cochrane Library, the China National Knowledge Infrastructure (CNKI This intervention should be implemented in public health policy to encourage elderly patients to participate in regular resistance exercise regimens.

Cancer and gouty arthritis were both positively associated with malnutrition. A relationship between serum albumin and nutritional status could explain the strong association between gout and malnutrition. Serum albumin levels may indicate protein-losing disorders, dietary deficiency or systemic inflammation. For each 1 g/L of lower serum albumin, the likelihood of gout increased by 9%, which could be explained by ongoing systemic inflammation.[27] side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc. In inflammatory states, cell capillary permeability was increased, resulting in albumin flux into cells and a heightened oxidation and scavenging process. In addition, albumin functions as an intracellular amino acid donor for cell proliferation, which was significantly more prevalent in inflammatory states. Consequently, albumin degradation was greater in inflammatory states than in normal states, resulting in decreased albumin mass despite the possibility of increased albumin synthesis during the inflammatory process.[28, 29] side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc.

However, the associations between cancer and malnutrition could have been caused by multiple factors including illness symptoms such as nausea, vomiting, anorexia and dysphagia[30] side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc. and side effects from chemotherapy or radiation and gastro-intestinal obstruction.[31]side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc. Hence, elderly individuals with cancer and gouty arthritis require closer dietary monitoring; therefore, consulting a nutritionist is recommended.

The relationship between the history of COVID-19 and malnutrition necessitated a discussion of four areas. Initially, the virus entered the host's body using an angiotensin-converting enzyme 2 receptors, typically located in the lungs and gastrointestinal system. Due to the abundance of these receptors in the gastrointestinal system, they have become one of the primary targets of SARS-CoV-2.[32, 33] side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/

or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc. Thus, in addition to respiratory symptoms, the elderly with a history of COVID-19 exhibit severe digestive system symptoms. Second, COVID-19 increases the production of acute-phase proteins during an acute inflammatory response, requiring the consumption of albumin and muscle protein.[34]side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc. Subsequently, COVID-19 caused symptoms such as anxiety and loss of appetite, which may eventually lead to malnutrition. [35] side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc. Lastly, malnutrition can increase the likelihood of COVID-19 by reducing T- and B-cell production due to lymphoid organ atrophy.[36] side effects of anticancer therapies can also lead to inadequate nutrient intake and subsequent malnutrition. The nutritional screening aims to identify patients at risk of malnutrition for prompt treatment and/or careful follow-up. Methods and results: This manuscript highlights the need of an interdisciplinary approach (oncologist, nutritionist, dietitian, psychologist, etc. Nonetheless, malnutrition may alter innate and adaptive immune responses, increasing susceptibility to COVID-19. The reduced T-cell response was caused by structural and functional thymic involution. All complement components (except C4) are diminished in emaciated patients, particularly C3 and factor B. In addition, malnutrition impairs phagocytic function and the production of cytokines and antibodies.[37] caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 Malnutrition might thus have an impact on those prone to COVID-19. Therefore, patients with COVID-19 should be assessed for malnutrition and given treatment as soon as possible in both nutritional status and COVID-19 treatment to prevent further morbidity and mortality.

This study encountered limitations. The number of patients was comparatively low, resulting in minuscule totals in each category. Due to the small sample size, the confidence interval for the estimated odds ratio was relatively wide. Additionally, the present study was conducted in a single hospital; the data may not be generalizable to the entire country, but they may reflect the situation of malnutrition and the risk of malnutrition patients in community hospitals in Thailand.

Conclusion

Malnutrition constitutes a devastating condition with several comorbidities among the elderly posing a significant worldwide public health problem. The history of COVID-19 and physical activity were associated with malnutrition, whereas cancer, gouty arthritis and physical activity were associated with those at risk for malnutrition. In addition, residing in a community hospital may indicate a lack of access to health literacy; therefore, the Ministry of Public Health and healthcare providers should develop comprehensive guidelines and strategies to screen and prevent malnutrition among the elderly as one of the standard healthcare systems and educate themselves on malnutrition and its complications.

Acknowledgments

The authors would like to acknowledge the Director and staff of the Bangkhla Hospital, Chachoengsao Province, for their assistance. In addition, we would like to express our appreciation to the staff of the Department of Military and Community Medicine, Phramongkutklao College of Medicine, for their support.

Conflict of interest

All authors declare that they have no conflicts of interest.

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