ORIGINAL ARTICLE

Prevalence and related factors of possible sarcopenia among Thai community-dwelling older adults

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ABSTRACT

Sarcopenia is a geriatric syndrome that increases the risk of fall-related injury. Low muscle strength with or without reduced physical performance is used to identify possible sarcopenia, or those at risk of sarcopenia. To date, there is limited evidence available regarding the situation of sarcopenia risk among Thai older adults. Our study evaluated the prevalence of possible sarcopenia and determined the related factors among Thai community-dwelling older adults. Information about socio-demography, chewing difficulty, and food consumption was collected by interview as well as anthropometric measurements. Possible sarcopenia was defined using the recommendation of the 2019 Asian Working Group for Sarcopenia (AWGS) consensus. Factors that were related to possible sarcopenia were examined using multiple logistic regression, presented as adjusted odds ratios (AOR) and their 95% confidence intervals (CI). Participants were randomly selected using multi-stage sampling from population registers provided by local village health staff in selected sub-districts of Khon Kaen province. Among 510 older adults, the mean age was 69.1 (SD = 6.7) years, 67.3% were women, and 29.2% of them had chewing difficulty. The overall prevalence of possible sarcopenia was 32.2%. Women with high waist circumference (WC) had a higher rate of possible sarcopenia than men (25.9% and 10.5%, respectively). Factors relating to possible sarcopenia were chewing difficulty (AOR = 2.10; 95% CI: 1.36-3.22; p-value = 0.001), low mid-upper arm circumference or MUAC (AOR = 6.51; 95% CI: 3.40-12.47; p-value < 0.001), and normal waist circumference or WC (AOR = 2.14; 95% CI: 1.35-3.39; p-value = 0.001). Possible sarcopenia was prevalent among Thai community-dwelling older adults. Chewing difficulty, low MUAC, and normal WC were related to possible sarcopenia. Dietary and exercise modifications in this population are therefore a good target for lessening the occurrence of possible sarcopenia.

Key words:
chewing difficulty; mid-upper arm circumference; older adults; possible sarcopenia; Thai community; waist circumference

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INTRODUCTION

Sarcopenia is a major health issue for the elderly. Sarcopenia is associated with cardiovascular disease, diabetes mellitus, and cognitive impairment. This condition is also closely related to injury risk through decreased motor function, resulting in an increased risk of disability, loss of independence, and mortality[1, 2]. Given this burden, it is important to identify possible sarcopenia, or those at risk of developing sarcopenia, early and to apply effective interventions to reduce adverse health outcomes[3]. Possible sarcopenia was defined by the Asian Working Group for Sarcopenia (AWGS) 2019 as the condition of having low muscle strength with or without reduced physical performance, particularly in aged populations[4]. This definition was recommended for use in primary health care settings without advanced diagnostic equipment to identify people having risk for sarcopenia in order to facilitate diet and exercise interventions, as well as related health education, before referral to confirm diagnosis of sarcopenia[4]. From the 2019 AWGS consensus, possible sarcopenia diagnosis was recommended using two steps. First, calf circumference (CC) measurement or SARC-F[5] or SARC-Calf[6] questionnaire was used for identifying a case. Then, muscle strength measurement by hand grip strength (HGS) test or physical performance measurement by 5-time chair stand test in the second assessment step[4].

Previous studies have reported the prevalence and factors associated with possible sarcopenia in community-dwelling older adults. The prevalence of possible sarcopenia was 12.2% and 3.2% in Korean and Japanese community-dwelling older adults, respectively[7, 8]. As well, in Japan 30.1% of community-dwelling older adults that visited regional medical institutions had possible sarcopenia[9]. In Chinese older adults, possible sarcopenia prevalence was 38.5%, 31.1% and 41% in all, urban, and rural areas, respectively[10]. In Thailand, there was a study of possible sarcopenia among Thai elderly outpatients, which found that the rate of possible sarcopenia was 28.2%[11]. However, there has been no study addressing possible sarcopenia in Thai community-dwelling older adults.

To date most studies of this condition have combined participants with possible sarcopenia with the normal (no sarcopenia) group for comparison with the sarcopenia group (sarcopenia and severe sarcopenia). These studies were presented among Japan community-dwelling older adults and Thai outpatient elderly[9, 11]. One study has addressed number of teeth and masticatory function as associated with possible sarcopenia; nevertheless, their aim was to examine only oral health[7]. In Thailand, there have been limited studies aiming to determine the factors that were associated with possible sarcopenia. Thus, this study aimed to determine the prevalence of possible sarcopenia and the associated factors among Thai community-dwelling older adults to understand the risk of sarcopenia situation for applying in public health interventions. This study will fill a research gap in Thailand regarding the situation of possible sarcopenia and the risk factors for this condition.

METHODS

Study design

This was a cross-sectional study conducted in Northeast Thailand between June 2020 and October 2020. The settings were nine communities in three districts of Khon Kaen province: Muang district, Nampong district, and Chonnabot district. Three communities were randomly chosen from each district.

Participants

Our study calculated the required sample size based on the logistic regression method[12], which determined we needed to recruit 510 participants. People aged 60 years and over were randomly selected by multi-stage random sampling. First three districts were randomly selected in Khon Kaen province. In each district, three sub-districts were randomly selected. In each sub-district, nine villages were then randomly selected. Village health staff then provided population register details of people in the target age range and participants were randomly selected from these registers of population lists of those residing in the areas of interest. Population lists were obtained from local government officials. We then contacted the selected participants and asked them to join our study. We excluded people who had pain around the hand, arm, and leg or people who were not able to communicate with interviewers. Finally, 510 participants were included with willing consent.

Main outcome and independent variables

The data were collected via face-to-face interview with trained interviewers. The interviews were conducted in the community village hall as recommended by health promoting hospital staffs. We used a structured questionnaire for all baseline characteristics and a case record form for anthropometric measurement data. Chewing difficulty was assessed based on the answer to the question 'Do your teeth normally allow you to chew', if they answered 'normally' they were assigned to the 'no' group, while if they answered 'abnormal' they were in the 'yes' group. Data were also collected on consumption of herbs, alcohol, smoking, and food consuming problems (digesting, chewing, swallowing). A semi-food frequency questionnaire (semi-FFQ) was used for assessing food consumption and dietary patterns. Anthropometric measurements were collected including body weight (BW), height, middle-upper arm circumference (MUAC), and waist circumference (WC). The standard instrument was used to measure BW and height, then the body mass index (BMI) using Asian criteria was calculated by BW in kilograms divided by height squared in meters and categorized into 3 groups including underweight (< 18.5 kg/m^2), normal (18.5-22.9 kg/m^2), and overweight (≥ 23.0 kg/m^2)[13]. MUAC and WC were measured by an anthropometric tape and categorized into 2 groups. The cut-off point of low MUAC was < 29.3 centimeters for men and < 28.5 centimeters for women[14]. The cut-off point of high WC was > 90.0 centimeters for men and > 80.0 centimeters for women[15]. All questionnaires and a case record form were developed by the study's researchers and have been verified by experts.

Assessment of possible sarcopenia

Our study applied the identifying algorithm defined by the 2019 AWGS. The first step in case identification was calf circumference (CC) measurement using anthropometric tape. Cases were defined as having CC < 34.0 centimeters for men and < 33.0 centimeters for women[4]. Next, we used hand grip strength (HGS) measurement for determining the muscle strength using a handgrip dynamometer (Takei Digital Hand Grip Dynamometer, Japan) while sitting with 90^o elbow flexion[4, 16]. The cut-off point of low muscle strength was < 28 kg for men and < 18 kg for women[4]. Participants who have low HGS after these assessment steps were defined as possible sarcopenia cases (Figure 1).

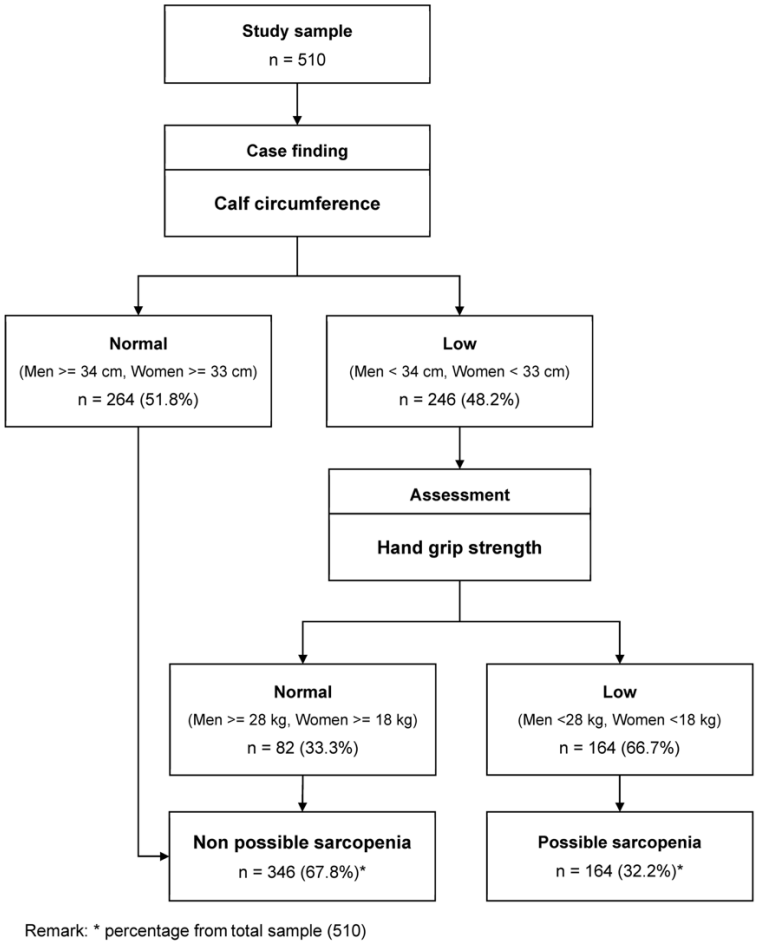


Figure 1. Identifying possible sarcopenia by using the AWGS 2019 algorithm

Statistical analyses

Demographic characteristics were summarized using mean, standard deviation (SD), median, minimum, and maximum range for continuous data, and categorical data were presented with frequencies and percentages. Prevalence was calculated using the number of possible sarcopenia cases divided by the total number of participants and presented as a percentage. Simple and multiple logistic regression were used for univariable and multivariable analysis, respectively to investigate the probable associations between the related factors and possible sarcopenia. The level of association between the independent variables and possible sarcopenia, one at a time was determined by crude odds ratio (OR) obtained from univariable analysis then estimated adjusted odds ratio (AOR) for all independent variables in multivariable model together with their 95% confidence intervals (CI) were obtained from multivariable analysis. A p-value of < 0.05 was considered as statistically significant in multivariable model as the final model. All statistical analysis was performed using Stata version 15 (StataCorp, College Station, TX).

Ethics approval

The research protocol was approved by the Khon Kaen University Ethics Committee for Human Research, reference number HE632051. All participants gave written informed consent to participate in the study.

RESULTS

Baseline characteristics, food consumption and frequency, and anthropometry data

Of 510 older adult participants, the mean age was 69.1 years (SD = 6.7), around two-thirds were women (67.3%) and married (62.6%), and almost all of them had finished primary school (97.3%). Around one-third had chewing difficulty (29.2%), and problems consuming food (29.4%), and around a quarter had low appetite in the past 3 months (23.7%). More than half of them consumed nuts at least 1 time per month (57.8%), fish at least 1 time per week (50.2%), eggs at least 1 time per week (57.8%), and vegetables every day (60.8%). Moreover, more than half were overweight (56.7%), and the majority had low MUAC and high WC (70.4% and 62%, respectively) (Table 1).

Table 1. Baseline characteristics, food consumption and frequency, and anthropometry data of participants (n = 510)

Factors	Number (%)
Age groups	
< 70 years	279 (54.7)
70 - 79 years	185 (36.3)
> 80 years	46 (9.0)
Mean ± SD	69.1 ± 6.7
Median (minimum, maximum)	68 (60, 92)
Gender	
Women	343 (67.3)
Men	167 (32.7)
Married status	
Single/widow/divorce/separate	191 (37.4)
Married	319 (62.6)
Education level	
No education	14 (2.7)
Primary school	439 (86.1)
Secondary school and above	57 (11.2)
Occupation	
None	204 (40.0)
Agriculture	182 (35.7)
Other	124 (24.3)
Income per month	
None	200 (39.2)
< 1000 baht	108 (21.2)
1000-4999 baht	140 (27.4)
≥ 5000 baht	62 (12.2)
Herb consumption	
No	428 (83.9)
Yes	82 (16.1)
Alcohol consumption	
No	426 (83.5)
Yes	84 (16.5)

Factors	Number (%)
Current smoking	
No	463 (90.8)
Yes	47 (9.2)
Weight loss in past 3 months	
No	353 (69.2)
Yes	110 (21.6)
unknown	47 (9.2)
Chewing difficulty	
No	361 (70.8)
Yes	149 (29.2)
Person responsible for cooking	
Self	312 (61.2)
Spouse	93 (18.2)
Others	105 (20.6)
Low appetite in past 3 month	
No	389 (76.3)
Yes	121 (23.7)
Food consuming problems	
No	360 (70.6)
Yes (Digest/chew/swallow)	150 (29.4)
Nuts consumption	
No	215 (42.2)
At least 1 time per month	295 (57.8)
Cow's milk consumption	
No	367 (72.0)
At least 1 time per month	143 (28.0)
Soymilk consumption	
No and at least 1 time per month	225 (44.1)
At least 1 time per week	191 (37.5)
At least 1 time per day	94 (18.4)
Fish consumption	
No and at least 1 time per month	33 (6.5)
At least 1 time per week	256 (50.2)
At least 1 time per day	221 (43.3)
Egg consumption	
No and at least 1 time per month	111 (21.8)
At least 1 time per week	295 (57.8)
At least 1 time per day	104 (20.4)
Chicken consumption	
No and at least 1 time per month	195 (38.3)
At least 1 time per week	247 (48.4)
At least 1 time per day	68 (13.3)
Daily fruit consumption	
No	363 (71.2)
Yes	147 (28.8)

Factors	Number (%)
Daily vegetable consumption	
No	200 (39.2)
Yes	310 (60.8)
Daily Fruit and vegetable consumption	
No	396 (77.7)
Yes	114 (22.3)
Body mass index	
overweight (≥ 23.0 kg/m^2)	289 (56.7)
normal (18.5-22.9 kg/m^2)	174 (34.1)
underweight (< 18.5 kg/m^2)	47 (9.2)
Mid-upper arm circumference	
Normal	151 (29.6)
Low (M < 29.3 cm, W < 28.5 cm)	359 (70.4)
Waist circumference	
High (M > 90 cm, W > 80 cm)	316 (62.0)
Normal	194 (38.0)

M=Men; W=Women

Factors related with possible sarcopenia using multivariable analysis

Of 510 older adults, the overall rate of possible sarcopenia was 32.2%. Univariable analysis, results showed that factors statistically related to possible sarcopenia were being unmarried, not being in the workforce, low monthly income, chewing difficulty, having someone other than themselves or their spouses preparing their food, low BMI, low MUAC, and normal WC (Table 2). There were two final models of multivariable analysis using multiple logistic regression. The first model controlled for the effect of chewing difficulty, MUAC, and WC (Model 1). The result from Model 1 showed that participants who had low MUAC had 6.45 (95% CI: 3.37-12.35; p-value < 0.001) times the chance of having possible sarcopenia compared with those with normal MUAC and participants who had normal WC had an increased chance of having possible sarcopenia by 1.93 times (95% CI: 1.27-2.93; p-value 0.002) compared with those with high WC. The second model controlled for the effect of gender, chewing difficulty, MUAC, and WC (Model 2). The results from Model 2 showed that participants who had low MUAC had 6.51 times (95% CI: 3.40-12.47; p-value < 0.001) increased chance of having possible sarcopenia compared with normal MUAC, and participants who had normal WC could increase the chance of having possible sarcopenia 2.14 times (95% CI: 1.35-3.39; p-value 0.001) compared with high WC (Table 3).

Table 2. Crude analysis of possible sarcopenia associated factors using simple logistic regression

Factors	Number of samples	Possible sarcopenia (%)	Crude OR	95% CI	p-value
Gender					0.204
Female	343	30.32	1		
Males	167	35.93	1.29	0.87-1.90	
Married status					0.039
Married	319	28.84	1		
Single/widow/divorce/separate	191	37.70	1.49	1.02-2.18	
Education level					0.060
Secondary school and above	57	21.05	1		
No and primary school	453	33.55	1.89	0.97-3.69	
Occupational					0.003
Other	124	20.97	1		
Agriculture	182	31.87	1.76	1.03-3.00	
None	204	39.22	2.43	1.45-4.07	
Monthly income					0.023
≥ 5000 baht	62	22.58	1		
1000-4999 baht	140	25.71	1.19	0.59-2.40	
< 1000 baht	108	40.74	2.36	1.16-4.79	
None	200	35.00	1.85	0.95-3.58	
Herb consumption					0.102
Yes	82	24.39	1		
No	428	33.64	1.57	0.91-2.70	
Alcohol consumption					0.202
Yes	84	26.19	1		
No	426	33.33	1.41	0.83-2.38	
Weight loss in past 3 months					0.081
No	353	29.46	1		
Yes	110	35.45	1.31	0.84-2.07	
unknown	47	44.68	1.93	1.04-3.59	
Chewing difficulty					< 0.001
No	361	27.15	1		
Yes	149	44.30	2.13	1.43-3.18	

Factors	Number of samples	Possible sarcopenia (%)	Crude OR	95% CI	p-value
Person responsible for cooking					0.001
Self	312	26.92	1		
Spouse	93	33.33	1.36	0.82-2.23	
Others	105	46.67	2.37	1.50-3.75	
Low appetite in past 3 month					0.115
No	389	30.33	1		
Yes	121	38.02	1.41	0.92-2.16	
Food consuming problems					0.231
No	360	30.56	1		
Yes (Digest/chew/swallow)	150	36.00	1.28	0.85-1.91	
Nuts consumption					0.089
At least 1/month	295	29.15	1		
No	215	36.28	1.38	0.95-2.01	
Body mass index					
overweight (≥ 23.0 kg/m^2)	289	20.07	1		< 0.001
normal (18.5-22.9 kg/m^2)	174	47.70	3.63	2.40-5.49	
underweight (< 18.5 kg/m^2)	47	48.94	3.82	2.01-7.24	
Mid-upper arm circumference					< 0.001
Normal	151	7.95	1		
Low (M < 29.3 cm, W < 28.5 cm)	359	42.34	8.50	4.55-15.90	
Waist circumference					< 0.001
High (M > 90 cm, W > 80 cm)	316	23.10	1		
Normal	194	46.91	2.94	2.00-4.32	

CI=Confidence interval; M=Men; N/A=Not available; OR=Odds Ratio; W=Women

Table 3 Multivariable analysis of factors that were related with sarcopenia using multiple logistic regression

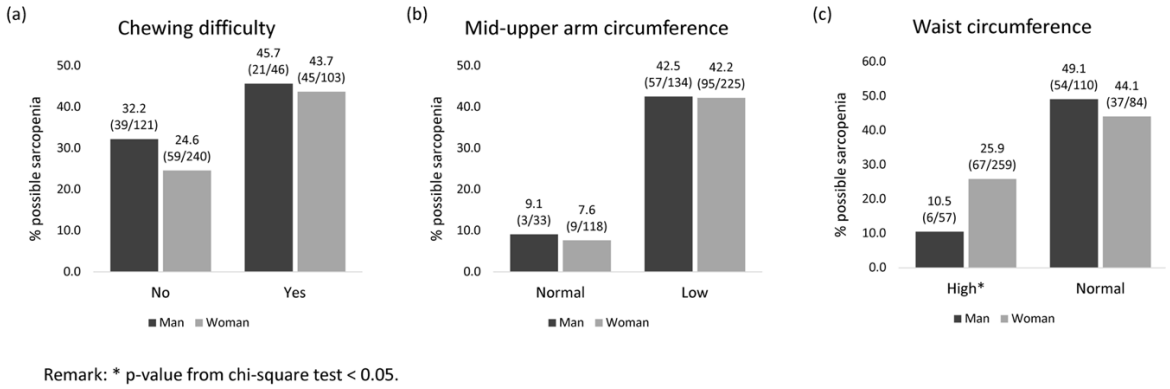
Factors	Number of samples	Possible sarcopenia (%)	Crude OR	Model 1			Model 2		
				AOR	95% CI	p-value	AOR	95% CI	p-value
Gender									0.274
Women	343	30.32	1	N/A	N/A		1		
Men	167	35.93	1.29	N/A	N/A		0.77	0.48-1.23	
Chewing difficulty						0.001			0.001
No	361	27.15	1	1			1		
Yes	149	44.30	2.13	2.11	1.37-3.24		2.10	1.36-3.22	
Mid-upper arm circumference						< 0.001			< 0.001
Normal	151	7.95	1	1			1		
Low	359	42.34	8.50	6.45	3.37-12.35		6.51	3.40-12.47	

Factors	Number of samples	Possible sarcopenia (%)	Crude OR	Model 1			Model 2		
				AOR	95% CI	p-value	AOR	95% CI	p-value
Waist circumference						0.002			0.001
High	316	23.10	1	1			1		
Normal	194	46.91	2.94	1.93	1.27-2.93		2.14	1.35-3.39	

AOR=Adjusted odds ratio; N/A=Not available; OR=Odds Ratio
Model 1 – Odds ratio adjusted for chewing difficulty, mid-upper arm circumference, and waist circumference;
Model 2 – Model 1 + adjusted for gender.

The rate of possible sarcopenia for each associated factor separated by gender

Figure 2 showed the comparative rates of possible sarcopenia between men and women in the chewing difficulty group, MUAC group and WC group. The results show the rate of possible sarcopenia among those with high WC was significantly higher for women (25.9%, 67/259) than men (10.5%, 6/57) with the p-value = 0.013 (Figure 2c).



Remark: * p-value from chi-square test < 0.05.

Figure 2. The rate of possible sarcopenia for each associated factor separated by gender

DISCUSSION

This is the first paper in Thailand to investigate the risks for possible sarcopenia among older community dwelling adults. Our results fill a knowledge gap about sarcopenia in Thailand. This result can improve the capacity of Thai health staff for promotion and protection against the risk of sarcopenia in the future to respond to this health challenge.

Possible sarcopenia participants in this study were defined as people who had low CC and low HGS (Figure 1). CC was positively correlated with appendicular skeletal muscle (ASM) and skeletal muscle index (SMM)[17]. The overall rate of possible sarcopenia found in our study (32.2%) was in accordance with the findings of previous studies, whereby the overall prevalence of possible sarcopenia was 38.5% among Chinese older adults, and 47.4% among older adults admitted to daycare centers in Taiwan[10, 18]. In addition, the prevalence of probable sarcopenia in Swiss older people following The European Working Group on Sarcopenia in Older People 2018 (EWGSOP2) criteria was 26.9%[19]. These results showed that the proportion of possible sarcopenia in Asian population using AWGS 2019 algorithm was more than the proportion determined using EWGSOP2 criteria. This may be dependent on nationality. From an ethnicity-related skeletal muscle (SM) study, Asians had the lowest SM value[20]. Additionally, Food and

Agriculture Organization of the United Nations reported that Asian countries had low per capita meat consumption[21]. Dietary protein is beneficial for building muscle mass[22].

Factors associated with possible sarcopenia were identified as: chewing difficulty, MUAC, and WC. For chewing difficulty, a previous study showed that chewing was associated with nutrition status and dietary intake according to the study among Thai older adults. It found that malnourished participants had lower mean chewing ability scores than those participants at risk of malnutrition and those with normal nutrition[23]. In addition, a study among community-dwelling older adults in rural United States showed that vitamin A, vitamin E and manganese were significantly low in those with chewing difficulties[24]. Insufficient intake of protein, vitamin D, antioxidants, especially vitamin E, vitamin C, carotenoids, and resveratrol, and long-chain polyunsaturated fatty acids had an important role to play in both the prevention and management of sarcopenia[25, 26]. Consequently, chewing difficulty could lead to possible sarcopenia. Moreover, a study among Japanese older adults reported that chewing food ability and teeth number were positively related to HGS[27]. Also, the study among Japanese community-dwelling older adults showed that perceived chewing ability was related to HGS, and the group who could chew only soft or pureed food (poor) had significantly lower HGS compared with the group who could chew all kinds of food[28, 29]. Furthermore, chewing difficulties were associated with all the domains of geriatric assessment and logistic regression analysis presented that sarcopenia was an independent factor associated with chewing difficulties[30].

Low MUAC was associated with the presence of possible sarcopenia in this study. The cut-off point that we used for MUAC categorization was used for nutrition status assessment. Therefore, participants who had low MUAC were determined to have low nutrition status; malnutrition. Malnutrition and sarcopenia have a clinical relationship through the combination of decreased body weight and nutrient intake, along with a decrease in muscle mass and function[31]. Moreover, malnutrition is one of the key pathophysiological causes of sarcopenia[31]. Thus, low MUAC has a plausible association with possible sarcopenia. Our results were in line with a study among Malaysia community-dwelling older adults which found an association between MUAC and HGS[32]. In addition, MUAC was strongly correlated with appendicular skeletal mass index (ASMI) among community-dwelling middle-aged and older adults in China[33]. Furthermore, low MUAC was more strongly associated with mortality[34].

WC was another factor associated with possible sarcopenia. It is one component of the diagnosis of metabolic syndrome[35]. Clinically, abdominal obesity is identified by an increase in WC [36]. The longitudinal study showed that visceral obesity was associated with the future loss of SMM in Korean adults[37]. Accordingly, the study among Korean older adults found that participants with sarcopenic obesity had significantly low ASM and high WC[38]. On the contrary, our results found that normal WC was significantly associated with possible sarcopenia. In the same results with the study among Chinese patients with type 2 diabetes mellitus, ASM was significantly and positively correlated with WC[39].

Regarding gender, our women participants with high WC were more likely to have possible sarcopenia than men participants with high WC. Likewise, sarcopenia was associated with metabolic syndrome in men with normal WC and women with high WC[40]. However, in our study gender was not related to possible sarcopenia. This may be because older women developed increased visceral fat

during the ageing progress compared with men. Meanwhile, older men, even when they had normal WC, might have confounding lifestyle factors such as alcohol consumption and smoking which were associated with loss of muscle mass[41, 42].

Therefore, possible sarcopenia and sarcopenia screening should be recommended as a standard assessment in primary health care practice with suitable screening following the AWGS 2019 algorithm.

There were some limitations of this study. First, we did not research factors about body composition such as muscle mass, fat mass, as well as the protein and energy intake which might be related to possible sarcopenia. The body composition could be evaluated by using a bioelectrical impedance analyzer (BIA). The small type of BIA with comfort and mobility was recommended for community settings and should be applied to the next study. Second, our study was conducted only in some areas of Northeastern Thailand and might not be generalizable to other settings.

CONCLUSION

The prevalence of possible sarcopenia among Thai community-dwelling older adults was high. The factors that increase the chance of having possible sarcopenia were chewing difficulty, low MUAC, and normal WC. Although our older participants with normal WC were significantly associated with possible sarcopenia, older women with high WC had significantly higher risk of possible sarcopenia compared with older men. All related factors have a correlation with nutritional status, therefore nutrition management in older adults especially in the community is particularly important to reduce possible sarcopenia cases.

RECOMMENDATION

A larger sample size is recommended for discovering further factors that were associated with possible sarcopenia. Furthermore, the study about the association between WC and possible sarcopenia should be conducted to clarify the imprecise association.

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