Prevalence and Predictors of Sarcopenia in Older People with Type 2 Diabetes

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Abstract: Sarcopenia is associated with loss of muscle mass and muscle strength, causing poor physical performance and falls; however, research about this is still limited in Thailand, particularly in older people with type 2 diabetes mellitus. This study investigated the prevalence of sarcopenia, and its components (muscle mass, handgrip strength and gait speed) associations with personal factors (age, gender, co-morbidity and time since diagnosis), and health and behavioral factors (hemoglobin A1c, body mass index, waist circumference, depression and physical activity) in older people with type 2 diabetes mellitus. Data were collected from 396 older people residing in Bangkok and surrounding areas using structured interviews, nutrition and health assessment, body composition analyzer, handgrip dynamometer and a 6-meter walk test. Descriptive statistics and univariate and multivariate logistic regression were used to analyze the data.

Results revealed that the prevalence of sarcopenia was 1.3%. The univariate logistic regression indicated that age and gender were significantly associated with handgrip strength and gait speed. Body mass index and waist circumference were significantly associated with only handgrip strength; while depression and physical activity were significantly associated with handgrip strength and gait speed. The multivariate logistic regression showed that age, gender and waist circumference could together predict handgrip strength. Moreover, age, gender, depression and physical activity together predicted gait speed. Nurses need to promote physical activity, monitor depression and provide advice to older people to help control their body weight and visceral fat.

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Background

The aging population is currently increasing worldwide as well as in Thailand, a Southeast Asian country. It has been estimated that the Thai population will soon become a super-aged society.[1] With advancing age, older people are at risks for a significant decrease

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in muscle mass, and increase in fat mass particularly visceral fat,[2] resulting in a high risk of insulin resistance and type 2 diabetes mellitus (T2DM),[3] a common public health problem among Thai older people.[4] According to the Fifth Thai National Health Examination Survey (NHES V), insulin resistance, T2DM, and metabolic syndrome lead to a decline in muscle mass associated with sarcopenia.[4]

Sarcopenia is considered a syndrome associated with older people.[5] The literature revealed that major factors causing sarcopenia in older people with T2DM are biological or personal factors. Age-related physiological changes lead to muscle wasting and loss of ability to restore and rebuild muscle.[3,5,6] In addition, females generally have less muscle mass associated with a decrease in hormone, thus, they are more likely to have sarcopenia than males.[5] Co-morbidity also leads to functional decline, involving inflammatory processes and endocrine function.[5,7] Thus, the more co-morbidities, the less physical fitness[8] and a longer time since diagnosis of diabetes results in more insulin resistance and protein degradation in muscle. [9,10,11]

Among older people with T2DM, health indicators associated with sarcopenia are that hemoglobin A1c indicates the severity of hyperglycemia, leading to an increase in the formation of advanced glycation end products (AGEs) that accumulate in cartilage and skeletal muscle, causing lower handgrip strength, and gait speed together with moderate-to-severe physical impairments.[12] Low body mass index (BMI) is associated with inadequate dietary protein intake[14] whereas being overweight or obese link with inflammatory cytokines, causing losses of muscle strength and muscle mass, leading to sarcopenia.[11,12,15] Waist ci rcumference (WC) and depression affect immune-mediated inflammation and increase inflammatory cytokines IL-6 and TNF-α, and C-reactive protein production.[14,16,17] These cytokines play a major role in the process of muscle breakdown that causes muscle loss and sarcopenia.[5,18] Also, physical inactivity is a leading cause of reduced muscle mass and muscle strength.[19,20]

The prevalence of low muscle mass was found to be 5-13% in older people, and increased to 50% in those at the age of ≥80 years.[21] Moreover, insulin resistance can lead to decreased muscle, increased gluconeogenesis and hyperglycemia,[22] causing sarcopenia among those with T2DM.[12,13] The major consequences of sarcopenia include low physical performance, risks of fall, frailty and bone fracture,[21] a decline in daily activity, increased needs of assistance with self-care, along with medical treatment, prolonged hospitalization associated with infection, readmission, and premature mortality.[23]

According to previous studies in Thai older people, the prevalence of sarcopenia was 30.5%[24] and 13.6%[14] in community dwellers, while it was 9.6% in urban communities.[25] T2DM is associated with an increased risk of impaired muscle strength and performance in older people[12] with the possibility of developing frailty and sarcopenia, which are preventable.[26] Studies on sarcopenia in Thai older people with T2DM are scarce, and so the authors believed it was necessary to describe the prevalence of sarcopenia and examine factors associated with it, so as to develop strategies to prevent or delay its development.

Aims

This study aimed to 1) describe the prevalence of sarcopenia in older people with T2DM, and 2) investigate the relationship and predictability of personal factors (age, gender, co-morbidity and time since diagnosis) and health and behavioral factors (hemoglobin A1c, body mass index (BMI), waist circumference (WC), depression and physical activity) with each component of sarcopenia (muscle mass, handgrip strength and gait speed) in older people with T2DM in Thailand.

Methods

Design

This study used a descriptive correlational design.

Sample

Through purposive sampling, the sample consisted of older people with T2DM aged ≥60 years who resided in six communities in Bangkok Metropolitan Region (BMR) and surrounding areas between December 2017-April 2018. The inclusion criteria were: 1) being diagnosed with T2DM for at least 1 year; 2) Having normal cognitive status as screened by the Chula mental test[30] with score of ≥15; 3) Being ambulatory with no need for walkers or assistive equipment; 4) Not having severe diabetes complications; and 5) Having blood pressure ≤140/90 mm Hg. Exclusion criteria included 1) having contraindication for the walking test; 2) Having musculoskeletal disorders; and 3) Taking steroids and thyroid hormones that might affect body weight or body composition.

The sample size determination in this study was based on the formula of Kelsey, Whittemore, Evans & Thompson (1996)[27] which is $n = Z\sigma^2 z/L^2 = 1.96 \times 10^2 = 384$ where: n = sample size; Z = probability of type I error at .05 = 1.96; σ = variance; L^2 = acceptable error for the estimation of sample mean = .01, obtaining a sample of 384. Approximately 3% was added for incomplete data; therefore, the final sample was 396.

Instruments

Four questionnaires were used with permissions from original authors. The content validity was examined by three experts in nutrition, geriatric care and community-based diabetic care. Instruments used were:

1) Screening tools:

Cognitive Screening Instrument: The Chula Mental Test (CMT) developed by Jitapunkul,[28] was used to screen for cognitive function by asking potential participants to respond to 19 questions such as "how old are you?" and "what time is it?". The score for a correct answer was 1 and an incorrect answer was 0. Possible scores ranged from 0-19. Those with the total score <15 were considered to have cognitive impairment and excluded from the study. Psychometric properties of the CMT were tested, revealing that content validity, criterion validity and reliability coefficient were acceptable.[28]

A *digital sphygmomanometer* was used to measure blood pressure (BP) in each potential participant in a resting position for at least 15 minutes. The inclusion criteria was less than 140/90 mmHg.[29]

2) The Personal Factors Questionnaire, developed by the researchers based on a literature review, was used to collect data on age in years, gender, co-morbidity (as described by numbers of underlying diseases other than T2DM), time since diagnosis in years, marital status, religion, education level, occupation, personal income, family income, numbers of family members, medication type, weight loss status, changes in food intake, and fall history in the past year.

3) Assessment tools for health and behavioral factors

Assessment of health and behavioral factors included two questionnaires and tools assessing nutritional status.

*Thai Geriatric Depression Scale (*TGDS), developed by Train the Brain Forum Committee,[30] was used to assess depression within the past week. This has 30 items including 20 negative questions (such as "Have you dropped many of your activities and interests?") and 10 positive questions (such as "Are you basically satisfied with your life?"). Response to items is a "yes" or "no". For negative questions, the response is scored as 1 if the answer is "yes" and as 0 if the answer is "no". The score is reversed for the positive questions. The possible scores range from 0-30 and are classified into 4 levels: normal (0-12), mild depression (13-18), moderate depression (19-24); and severe depression (25-30). Later in the logistic regression analysis, the scores are combined and classified into 2 groups (0=normal; 1=depressed). Cronbach's alpha coefficients for the original TGDS and this study were .91, and .75, respectively.

The *Global Physical Activity Questionnaire (GPAQ) version 2* was developed by the World Health Organization (WHO) and translated in Thai by Aekplakorn,[4] and has 16 items with three dimensions of physical activity: work (6 items); transportation (walking and cycling: 3 items); and leisure (recreational activity: 6 items and sedentary activity: 1 item). The questions ask the intensity of physical activity (moderate or vigorous), duration (min/day), and frequency of activity (day/week). According to intensity levels, data are then converted to Metabolic Equivalent Tasks (METs) by calculating total time spent in each physical activity during a week, then multiply by 4 for moderate and 8 for vigorous intensity, obtaining a MET value based on each intensity. Total physical activity refers to the total MET value (MET-min/week), and is classified into three levels: 1) vigorous (≥ 3 days/week of vigorous-intensity physical activity and total MET ≥1500 METs-min/week; or ≥7 days/week of either moderate or vigorous intensity physical activity and total MET ≥3000 METs-min/week); 2) moderate (≥ 3 days/week of vigorous-intensity physical activity for ≥ 20 minutes per day; or ≥5 days per week for at least 30 minutes per day; or ≥5 days per week of either moderate or vigorous intensity physical activity and total MET ≥600 METs-min/week); and 3) sedentary and light (lower than moderate level of total physical activity). The Item Content Validity Index (I-CVI) was 1.00 indicating the I-CVI was acceptable according to Lynn.[31] In a 1-week interval, the test-retest reliability from a pilot-test with 30 older people was .89.

Tools assessing nutritional status included body composition analyzer, height meter and non-stretchable nylon tape. *Body weight* was measured in kilograms (kg) using a body composition analyzer (TANITA-420) with monthly calibration in which the participants were asked to wear light clothing with barefoot and stand on the analyzer. *Height* was measured to the nearest 0.1 cm using a height meter fixed to the wall where the participants were asked to take a standing position without shoes. *Body mass index (*BMI*)* was calculated using the formula weight (kg)/Height (meter^2). Interpretation was based on the WHO Western Pacific Region standard[32] as classified into underweight (<18.5 kg/m^2), normal (18.5-22.9 kg/m^2), overweight (23-24.9 kg/m^2), obesity class I (25-29.9 kg/m^2), and obesity class II (≥ 30 kg/m^2). *Waist circumference (*WC*)* was measured using the same standard[32] in which a non-stretch tape was used to measure WC in a horizontal plane at the level of the middle between the lower margin of the lowest rib and the iliac crest to the nearest 0.1 cm. Participants were classified into "central obesity" when WC >90 cm in the male and WC >80 cm in the female. *Hemoglobin A1C and blood glucose level data* were collected from the patients' medical records, while participants, who did not have the previous record, had their hemoglobin A1c measured at the health service.

4) Assessment tools for sarcopenia

Muscle mass was measured using a body composition analyzer (TANITA-420) with monthly calibration as calculated from: skeletal muscle mass (SM) = [0.401x (height^2/resistance) + 3.825 x gender - 0.071 x age + 5.102], where height was in cm and resistance in ohms; gender was coded for female (0) and male (1); age was in years. Skeletal muscle mass index (SMI) was based on SM/ height^2. Low muscle mass was classified as SMI < 7.0 kg/m^2 in male and < 5.7 kg/m^2 in female.[7] *Handgrip strength* was measured using a digital handgrip dynamometer based on ISO-standard. Participants were asked to exert maximum effort twice using their dominant hand, then the average was used for data analysis. Low handgrip strength was defined as <26 kg in male and <18 kg in female.[7] *Gait speed* was measured using a stopwatch and a 6-meter walk. The participants were asked to stand with their toes touching the start line then walk at a usual pace a few steps beyond the finish line. One of the research assistants walked with each participant to prevent them from falling or any accident. The time to finish a 6-meter walk was recorded in seconds. The gait speed was then calculated in meter/second. Low gait speed was defined as ≤0.8 meters/second in both male and female.[7] Interrater reliability was tested with greater than .80 prior to the gait speed measurement.

The Asian Working Group for Sarcopenia (AWGS) criteria were used to identify sarcopenia severity three levels: 1) Pre-sarcopenia refers to low muscle mass solely, 2) sarcopenia refers to low muscle mass with low handgrip strength or low gait speed, and 3) severe sarcopenia refers to low muscle mass, low handgrip strength and low gait speed.[7]

Ethical Considerations

This study was approved by the Institutional Review Board on Research Involving Human Subjects of the Faculty of Medicine, Ramathibodi Hospital (ID 09-60-14) and the Faculty of Medicine Siriraj Hospital, Mahidol University (Protocol number 820/2560 EC4). Data were collected according to the principle of protecting the rights of human subjects. The participants were asked to sign the informed consent form to indicate their willingness to participate in the study as well as their right to withdraw, and assurances of privacy and confidentiality.

Data collection

The data were collected using a structured interview, nutritional assessment, body composition analyzer, handgrip dynamometer and a 6-meter walk test. There were five research assistants (RIs) consisting of three professional nurses and two public health volunteers. These RIs were well-trained and well-instructed to ensure consistency of data collection which was undertaken at four stations. Station 1 was registration, measurements of blood pressure, and cognitive screening. Three older people did not meet cognitive screening criteria. Station 2 was a measurement of height and waist circumference. The participants then responded to the questionnaires through structured interview lasting approximately 20 minutes per participant. Station 3 was for body weight, body composition, and hand grip strength test and Station 4 was for the 6-meter gait speed test.

Data analysis

Descriptive statistics were used to analyze data regarding personal information, health and behavioral factors, and components and prevalence of sarcopenia. Univariate logistic regression examined associations of personal factors (age, gender, co-morbidity and time since diagnosis), and health and behavioral factors (Hemoglobin A1c, BMI, waist circumference, depression and physical activity) with each component of sarcopenia, comprising of muscle mass, handgrip strength and gait speed. The personal factors were categorized including age (0=60-69; 1=70-79; 2= ≥80 years), and gender (0=female; 1=male) while co-morbidity and time since diagnosis were measured as continuous scale. The health and behavioral factors were classified to include BMI (0= <18.5; 1=18.5-22.9; 2=23-24.9; 3=25-29.9; 4=≥30 kg/m^2), waist circumference (0=normal; 1=excessive), depression (0=normal; 1=depressed), and physical activity (0=sedentary and light; 1=moderate; 2=vigorous), while hemoglobin A1c was measured as continuous scale. Multivariate logistic regression was used to examine personal factors and health and behavioral factors together predicting handgrip strength and gait speed in participants. Assumptions were met.[33]

Results

The majority of participants were female (75.5%) with a mean age of 68.6 ± 6.8 years, ranging from 60-89 years (Table 1). Half of them lived in Bangkok (50.8%); 52% were married and 55.1% were from an extended family. Most were Buddhists (98.4%), had primary education or lower (76%), and did not work (63.8%). Their income was mainly from welfare benefits for older people and allowances from the relatives with a median income of 2,700 baht per month (82 USD), while the median household income was 10,000 baht per month (305 USD).

The median time since diagnosis of T2DM was 10 years, ranging from 1-26 years. Approximately 52% had their blood glucose level at or below 130 mg/dl; and 54.3% had their hemoglobinA1c within the normal range (< 7 %). Most took only an oral antidiabetic drug (93.6%), had no experience of weight loss (86.6%), and no changes in food intake (73.5%) with comorbidities (93.2%). The most common health problems were hypertension (81.8%) and dyslipidemia (61.9%).

Participants had sedentary and light physical activity mostly at the highest rank (44%), following by a moderate level (37.6%) (Table 1). In terms of mental health, 85.1% had no depression, while 11.1% had mild depression and 3.8% had moderate to severe depression. Regarding nutritional status, only 21.8% had a normal BMI while 37.9% had obesity (class I) and 19.9% were overweight; 88% of females and 57.7% of males had excessive waist circumference.

According to the AWGS criteria[7], only 5 female participants (1.3%) had sarcopenia. Among these, four had severe sarcopenia and one had sarcopenia. The majority (98.7%) had normal muscle mass, 55.3% had normal handgrip strength and 44.7% had low handgrip strength, while 66.2% had low gait speed (Table 2).

Table 1 Description of the study variables (n = 396)

Variables	Mean ± SD	n (%)
Age (years)	68.6 ± 6.8	
Gender		
Female		299 (75.5)
male		97 (24.5)
Co-morbidity (number of underlying diseases)		
Diabetes only		27 (6.8)
1		139 (35.2)
2		197 (49.7)
3		29 (7.3)
4		4 (1.0)
Time since diagnosis (years)	9.7 ± 7.2	
Hemoglobin A1c (mg%)	7.1 ± 1.6	
Body mass index (kg/m^2)	26.2 ± 4.6	
Waist circumference (cm)		
Male	92.9 ± 9.9	
Female	90.6 ± 9.9	
Depression	7.1 ± 5.1	
Physical activity		
Sedentary and light		174 (44.0)
Moderately		149 (37.6)
Vigorous		73 (18.4)

Table 2 Components of sarcopenia in the participants based on the Asian Work Group for Sarcopenia (AWGS) Criteria (n=396)

Components of sarcopenia	Male n (%)	Female n (%)	All n (%)
Muscle mass			
Normal	97 (24.5)	294 (74.2)	391 (98.7)
Low	-	5 (1.3)	5 (1.3)
Handgrip strength			
Normal	64 (16.2)	155 (39.1)	219 (55.3)
Low	33 (8.3)	144 (36.4)	177 (44.7)
Gait speed			
Normal	48 (12.1)	86 (21.7)	134 (33.8)
Low	49 (12.4)	213 (53.8)	262 (66.2)
Sarcopenia			
No	97 (24.5)	294 (74.2)	391 (98.7)
Yes	-	5 (1.3)	5 (1.3)
Pre-sarcopenia	-	-	-
Sarcopenia	-	1 (0.3)	1 (0.3)
Severe sarcopenia	-	4 (1.0)	4 (1.0)

Due to the low prevalence of sarcopenia in older people with T2DM, we were unable to perform the statistical analysis as previously planned. Consequently, we changed an initial main variable from "sarcopenia" to "components of sarcopenia", comprised of muscle mass, handgrip strength and gait speed based on the AWGS criteria. Afterward, we examined associations of personal factors (age, gender, co-morbidity and time since diagnosis), and health and behavioral factors (hemoglobin A1c, BMI, WC, depression and physical activity) with each sarcopenia component.

Univariate logistic regression revealed that all personal, health and behavioral factors were not significantly associated with muscle mass. However, personal factors (age and gender), and health and behavioral factors (body mass index, waist circumference, depression and physical activity) were significantly associated with handgrip strength. The participants with severe depression were more likely to have low handgrip strength, while females were less likely to have low handgrip strength. However, co-morbidity, time since diagnosis and hemoglobin A1c were not significantly associated with handgrip strength (Table 3).

Table 3 Univariate Logistic Regression examining factors associated with handgrip strength in the participants (n=396)

Factors	Normal handgrip strength n (%)	Low handgrip strength n (%)	B	OR	95% CI	p
Age			.080	1.083	1.050-1.118	<.001
Gender			-.589	.555	.344-.895	.016
Female*	155 (51.8)	144 (48.2)				
male	64 (66.0)	33 (34.0)				
Co-morbidity			.207	1.230	.946-1.599	.122^{ns}
Time since diagnosis			.014	1.014	.968-1.042	.333^{ns}
Hemoglobin A1c			.043	1.044	.921-1.184	.501^{ns}
Body mass index			-.047	.954	.913-.998	.039
Waist circumference			-.031	.970	.950-.990	.003
Depression			.081	1.084	1.040-1.130	<.001
Physical activity			-.281	.755	.577-.987	.040
Sedentary and light*	86 (49.4)	88 (50.6)				
Moderate	87 (58.8)	61 (41.2)				
Vigorous	46 (62.2)	28 (37.8)				

OR=Odd ratio, CI=Confident interval; ns= No statistical significance

*Reference group

Personal factors (age and gender) and health and behavioral factors (depression and physical activity) were significantly associated with gait speed. The participants with severe depression were more likely to have low handgrip strength, while female gender was less likely to have low handgrip strength. However, co-morbidity, time since diagnosis, hemoglobin A1c, BMI and waist circumference were not significantly associated with gait speed (Table 4).

Multiple logistic regression analysis revealed that three out of nine factors (age, gender and waist circumference) together could predict handgrip strength with 15.8% of the variance in handgrip strength (Table 5). Participants aged ≥80 years were 5 times more likely to have low handgrip strength than those aged 60-69 and 70-79 years (95% CI 2.198-11.364). Females were 0.5 times more likely to have low handgrip strength than males (95% CI 0.286-0.876). Participants with waist circumference ≤80 cm in females or ≤90 cm in males were 0.5 times more likely to have low handgrip strength than those with excessive waist circumference (95% CI 0.257-0.987) when controlling for other variables (Table 5).

Table 4 Univariate Logistic Regression examining factors associated with gait speed in the participants (n=396)

Factors	Normal gait speed n (%)	Low gait speed n (%)	B	OR	95% CI	p
Age			.082	1.085	1.047-1.124	<.001
Gender			-.886	.412	.258-.660	<.001
Female*	86 (28.8)	213 (71.2)				
male	48 (49.5)	49 (50.5)				
Co-morbidity			.239	1.269	.963-1.673	.090[ns]
Time since diagnosis			.010	1.010	.981-1.040	.502[ns]
Hemoglobin A1c			.018	1.019	.892-1.164	.786[ns]
Body mass index			.004	1.004	.959-1.051	.858[ns]
Waist circumference			-.019	.981	.961-1.002	.083[ns]
Depression			.092	1.096	1.044-1.150	<.001
Physical activity			-.281	.621	.470-.822	.001
Sedentary and light *	45 (25.9)	129 (74.1)				
Moderate	54 (36.5)	94 (63.5)				
Vigorous	35 (47.3)	39 (52.7)				

OR=Odd ratio, CI=Confident interval; ns= No statistical significance
*Reference group

Table 5 Multivariate Logistic Regression examining factors associated with handgrip strength in the participants (n=396)

Factors	B	OR	95% CI	p
Age (years)				
60-69*				
70-79				
> 80	1.609	4.998	2.198-11.364	<.001
Gender				
Female*	-.692	.500	.286-.876	.015
male				
Waist circumference				
Normal*	-.686	.504	.257-.987	.046
Excessive				

Nagelkerke R^2 = .158; -2LL= 237.511; x^2 = 49.765; df=11; p<.001
OR=Odds ratio, CI=Confidence interval
*Reference group

Additionally, four out of nine factors (age, gender, depression and physical activity) together could predict gait speed with 14.2% the variance in gait speed (Table 6). Participants ≥80 years were 4.2 times more likely to have low gait speed than those 60-69 and 70-79 years (95% CI 1.529-11.300). Females were 0.5 times more likely to have low gait speed than male gender (95% CI 0.285-0.763). Participants with depression were 2.2 times more likely to have low gait speed than those with no depression (95% CI 1.068-4.527), and those with sedentary and light physical activity were 0.4 times more likely to have low gait speed than those with moderate and vigorous activity (95% CI 0.240-0.792) when controlling for other variables (Table 6).

Table 6 Multivariate Logistic Regression examining factors associated with gait speed in the participants (n=396)

Factors	B	OR	95% CI	p
Age (years)				
60-69*				
70-79				
> 80	1.425	4.157	1.529-11.300	.005
Gender				
Female*	-.762	.467	.285-.763	.002
male				
Depression				
No*				
Yes	.788	2.198	1.068-4.527	.033
Physical activity				
Sedentary and light *	-.831	.436	.240-.792	.006
Moderate				
Vigorous				

Nagelkerke R^2 = .142; -2LL= 82.733; x^2 = 42.677; df=6; p<.001
OR=Odd ratios, CI=Confidence interval
*Reference group

Discussion

The prevalence of sarcopenia in this study was lower than previous studies conducted in community-dwelling Thai older people that reported prevalences of 13.6%[14], and 9.6%,[25] while the prevalence of sarcopenia in older people with type 2 diabetes mellitus was 14.8% in China[35], and about 15.2% in Japan.[10] This could explained by the fact that the majority of the participants in our study were in the young-old group who took only antidiabetic drugs, had no experience with weight loss, normal blood glucose level and hemoglobin A1c, no change of food intake, no fall history in the past year, and undertook vigorous or moderate physical activity. Additionally, the participants in previous studies were at greater average age[10,14,25,35], with longer time since diagnosis and poorer hemoglobin A1c.[10,35]

Multivariate logistic regression revealed that the two personal factors, age and gender, and one of health and behavioral factors, waist circumference, were the best predictors of handgrip strength with overall predictive power of 15.8% (Table 5), whereas the best predictor of gait speed was age following by depression, gender and physical activity with overall predictive power of 14.2 % (Table 6). The four predictive factors of gait speed were two personal factors, age and gender, and two of health and behavioral factors, depression and physical activity.

The strongest predictor of handgrip strength and gait speed in this study was of age being ≥80 years. Most of the participants with low handgrip strength (73%) and low gait speed were aged being ≥ 80 years. This result could be explained by the mechanism of age-related physical changes suggesting that muscle wasting and the loss of ability to restore and rebuild lost muscle is related with the aging process.[3,5,6] This was consistent with previous studies, indicating that aging-related biological changes could result in sarcopenia.[15,21,24]

Being female (a personal factor) was the second-best predictor of handgrip strength and the third-best predictor of gait speed. This indicates that females are more likely to have sarcopenia than males because they generally have less muscle mass than males,[5,9] and their hormonal levels decrease with advancing age, leading to muscle loss.[5,6] This was consistent with previous studies[14,15] indicating that sarcopenia is more common among females than males. The second-best predictor of gait speed was depression, a health and behavioral factor. This is also consistent with other studies,[14,18] indicating that changes in the hypothalamic-pituitary-adrenal axis affect immune-mediated inflammation and the increased inflammatory cytokines IL-6 and TNF-α stimulate CRP (C - reactive protein) production in those with severe depression. These cytokines play a major role in the process of muscle breakdown, causing muscle loss and leading to sarcopenia.[5]

The third-best predictor of handgrip strength was waist circumference ≤80 cm in females and ≤90 cm in male. This result is consistent with theories of the nutrition-related sarcopenia resulting from energy insufficient.[5] Hyperglycemia, common in diabetes, is associated with loss of muscle mass and strength because of weight loss.[34] Insulin resistance caus es the body to lose energy by moving glucose to the body cells, resulting in burning body fat and muscle.[13,22] Again this result is consistent with previous studies.[17,18]

Physical activity, a health and behavioral factor, was the fourth-best predictor of gait speed. This may be due to physical changes in aging process[2], indicating that older people with physical inactivity have more reduction of muscle mass and muscle strength, leading to sarcopenia[5,6] at 1.33 times a higher rate than those with adequate physical activity,[19] and while older people with moderate to vigorous physical activity have a lower risk for sarcopenia.[20]

As described in Table 2, all five participants with sarcopenia were female. Four of them had severe sarcopenia, and two of the four were in the old-old age (≥ 80 years old) and were depressed. In addition, one of these participants in the old-old age had 5 times the number of falls previously within one year.

Results in this study indicated that low handgrip strength was a powerful component of sarcopenia in older people with T2DM. The European Working Group on Sarcopenia in Older People in 2019[36] recommended that low handgrip strength is the primary indicator of sarcopenia in order to evaluate muscle quality and determine the feature of sarcopenia; whilst gait speed is also used to measure physical performance for categorizing the severity of sarcopenia.[36]

Study limitations

This study used a cross-sectional descriptive design, thus, a conclusion in terms of causal relationship is limited. Data collected for protein intake in food consumption record may have lacked accuracy. Probability sampling was not used; therefore, generalizability is limited only for older people with type 2 diabetes mellitus whose demographic and clinical characteristics are similar to the study sample.

Conclusions and recommendations for nursing practice and further research

The prevalence of sarcopenia in this study was 1.3%. Among personal factors, it was found that age was strongly associated with the two components of sarcopenia including handgrip strength and gait speed, followed by depression, waist circumference and physical activity. The results suggest that nurses and health teams need to screen for early detection of sarcopenia and enhance health behavioral modifications by promoting physical activity. Emphasis should placed on monitoring depression and providing advice aimed to control people's visceral fat, particularly in females at old-old age with T2DM. Nurses and health teams could also utilize data from this study as baseline information to further develop strategies for behavioral modification to ensure appropriate nutrition, and proper physical activity in order to prevent sarcopenia among older people, and for future study.

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ความชุกของภาวะมวลกล้ามเนื้อน้อยและปัจจัยในผู้สูงอายุที่เป็นเบาหวานชนิดที่ 2

บงกช วิริยะ นพวรรณ เปียซื่อ นรีมาลย์ นีละไพจิตร สุกัญญา ตันติประสพลาภ*

บทคัดย่อ: ภาวะมวลกล้ามเนื้อน้อยเกี่ยวข้องกับการสูญเสียมวลกล้ามเนื้อและความแข็งแรงของกล้ามเนื้อ เป็นสาเหตุสำคัญของสมรรถภาพทางกายลดลงและการหกล้ม แต่การศึกษาภาวะมวลกล้ามเนื้อน้อยในผู้สูงอายุของไทยยังมีจำกัดโดยเฉพาะในผู้สูงอายุที่เป็นเบาหวานชนิดที่ 2 การศึกษาครั้งนี้ มีวัตถุประสงค์เพื่อศึกษาความชุกของภาวะมวลกล้ามเนื้อน้อยและความสัมพันธ์ของปัจจัยส่วนบุคคล (อายุ เพศ จำนวนโรคร่วม และระยะเวลาที่เป็นโรคเบาหวานชนิดที่ 2) ปัจจัยภาวะสุขภาพและพฤติกรรมสุขภาพ (ระดับน้ำตาลสะสมในเลือด ดัชนีมวลกาย เส้นรอบเอว ภาวะซึมเศร้า และกิจกรรมทางกาย) กับองค์ประกอบของภาวะมวลกล้ามเนื้อน้อย (มวลกล้ามเนื้อ แรงบีบมือและอัตราเร็วในการเดิน) ในผู้สูงอายุที่เป็นเบาหวานชนิดที่ 2 เก็บรวบรวมข้อมูลในผู้สูงอายุที่เป็นเบาหวานชนิดที่ 2 เขตกรุงเทพมหานครและปริมณฑล จำนวน 396 คน ด้วยการสัมภาษณ์แบบมีโครงสร้าง ประเมินภาวะโภชนาการ องค์ประกอบของร่างกาย วัดแรงบีบมือ และทดสอบการเดินปกติระยะทาง 6 เมตร วิเคราะห์ข้อมูลด้วยสถิติบรรยาย และการวิเคราะห์ถดถอยลอจิสติค

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คำสำคัญ: ภาวะมวลกล้ามเนื้อน้อย มวลกล้ามเนื้อ อัตราเร็วในการเดิน ผู้สูงอายุ เบาหวานชนิดที่ 2 แรงบีบมือ ไทย

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