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Prevalence of Sarcopenia Among Ambulatory Elderly Egyptian Patients with Type 2 Diabetes Mellitus

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Abstract

Background: Sarcopenia is a well known geriatric syndrome but few studies address its prevalence among elderly with type 2 diabetes mellitus (T2DM). The etiology of sarcopenia is multi-factorial including related changes in the musculoskeletal, cellular and tissue structure and function. Skeletal muscles are involved in glucose metabolism and its impairment leads to insulin resistance. In the same context decrease in the skeletal muscle mass is the main contributor to sarcopenia. Therefore both diabetes and sarcopenia are related. Sarcopenia and diabetes both may lead to disability and premature mortality.

Aim of Study: This study aimed to determine the prevalence of sarcopenia among the elderly Egyptian patients with T2DM.

Patients and Methods: This study was conducted on 86 adults with T2DM aged 60 years. Socio-demographical data was collected, geriatrics assessment were done, glycated hemoglobin (HbA1c) and lipid profile were done for the studied cases. Sarcopenia was defined using the European Working Group for Sarcopenia in Older People (EWGSOP) criteria **[1]**.

Results: The proportion of elderly with T2DM with sarcopenia was 24.4%. Male sex and BMI showed statistically significant correlation with sarcopenia (p-value=0.005 and p-value=0.046 respectively). HbA1C, lipid profile, TSH level were not significantly associated with sarcopenia. Statistically insignificant correlations were obtained between diabetes treatment, diabetes complications, associated co-morbidities and sarcopenia (p-value=0.378, p-value=0.716 and p-value= 0.907) respectively. In addition, no statistically significant correlation was found between the different treatment modalities (oral antidiabetic drugs (OAD), insulin or both) and sarcopenia in our study.

Conclusion: The current study showed that the prevalence of sarcopenia among ambulatory Egyptian geriatric population aging 60 years and more was 24.4%. Male sex and BMI showed significant association with sarcopenia. HbA1C, lipid profile, TSH level was not significantly associated with sarcopenia. Different diabetes complications and different treatment modalities for diabetes showed no statistically significant association with sarcopenia.

Key Words: *Sarcopenia – Prevalence – Elderly – Diabetic – Type 2 Diabetes mellitus – Geriatric assessment tools.*

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Introduction

SARCOPENIA is a term used to describe the age related loss of skeletal muscle mass and related loss of the power and function **[1,2]**. Studies among the elderly population showed that around 10% of the elderly are prone to have sarcopenia **[3]**. The etiology of sarcopenia is multifactorial and related to age related changes in the mus culo skeletal, cellular and tissue structure and function. These factors include hormonal, neurological, immunological and metabolic changes **[4]**.

Both diabetes and sarcopenia negatively affects older people and contributes to premature mortality, hospitalization and disability **[4,5,6]**. Skeletal muscle is a cornerstone when it comes to glucose metabolism as well as defining sarcopenia. Skeletal muscles are involved in glucose metabolism and its impairment leads to insulin resistance. In the same context decrease in the skeletal muscle mass is the main contributor to sarcopenia. Therefore both diabetes and sarcopenia are related **[7,8]**.

Advances in the management of diabetes mellitus lead to increased prevalence of diabetes specially in the older people. Advances in diabetes research and diabetes-related complication highlighted the increased prevalence of frailty and sarcopenia as another diabetic complications in the elderly T2DM patients. Nowadays they became areas of new research interest **[9,10]**.

According to epidemiological studies, diabetes is involved in accelerated reduction of physical performance and muscle strength parameters, therefore lead to sarcopenia while conversely, the sarcopenic patients have higher sedentary behavior which increase the risk for diabetes **[11-14]**.

Studies among T2DM elderly patients revealed that diabetic complications and the type of medication the patients received influenced the incidence of sarcopenia in T2DM elderly patients **[15-17]**. Since diabetes and sarcopenia are inter-related, we aimed to study the prevalence of sarcopenia among the Egyptian elderly with type 2 diabetes mellitus (T2DM).

Material and Methods

Subjects:

This is a cross-sectional study. The study population included 86 Egyptian type 2 diabetic patients diagnosed with T2DM for at least 1 year (treated with any treatment modality; oral hypoglycemic drugs, insulin or both together) aged 60-89 years old. This was done through a stratified random sampling from the outpatient clinic of internal medicine clinic at Kasr Al-Ainy Hospital, Cairo University. The study was performed from December 2019 till November 2020.

We excluded the patients with known risks which hinder sarcopenia assessment; such as history of stroke, carpal tunnel syndrome, severe hip or knee osteoarthritis, use of walking aid and physical disabilities that affect hand-grip or walking.

Research protocols were approved by the medical ethics committee of Kasr Al-Ainy Medical School, Cairo University. After obtaining patients' informed consent, study questionnaire was filled to collect their demographic and clinical information about the duration of diabetes, presence of diabetic micro or macrovacular complications and presence of associating co-morbidities.

Anthropometric assessment was performed to measure height, weight, BMI was measured by bio-electrical impedance analysis machine (OMRON BF511 {HBF-511T-E}), waist and hip circumference. Fasting lipid profile (LDL-C, HDL-C&TG) were done using an automated chemistry auto analyzer. HbA 1 C was done for the studied cases.

Geriatric Assessment was done for the studied cases including mini nutritional assessment (MNA), mini mental state examination (MMSE), katz index of independence in activities of daily living and clinical frailty score.

Mini-nutritional assessment:

The Mini Nutritional Assessment (MNA) is a non-invasive and validated questionnaire done by the investigator to evaluate nutritional status in elderly people. With this scoring, sensitivity was found to be 96%, specificity 98% and predictive value of 97% **[18,19]**.

MNA is classified in three groups:

- <17: Malnourished
- >17 and <24: At risk of malnutrition.
- >24: Well-nourished, with a maximum of 30.

Mini-Mental State Exam (MMSE):

Mini-Mental State Examination (MMSE) is a 30-point questionnaire that is used extensively in clinical and research settings to measure cognitive impairment **[20]**.

Katz Index of Independence in Activities of Daily Living (ADL):

The ADL scale assesses the functional status of patients using dichotomus rating (dependant/ independent) of six ADLs in hierarchial order of decreasing difficulty as listed: Bathing, dressing, toileting, transferring, continence & feeding. The scale is out of 6, where 6 is considered independent in all activities while 0 is considered completely dependant **[21]**. Fig. (3).

Clinical frailty scale:

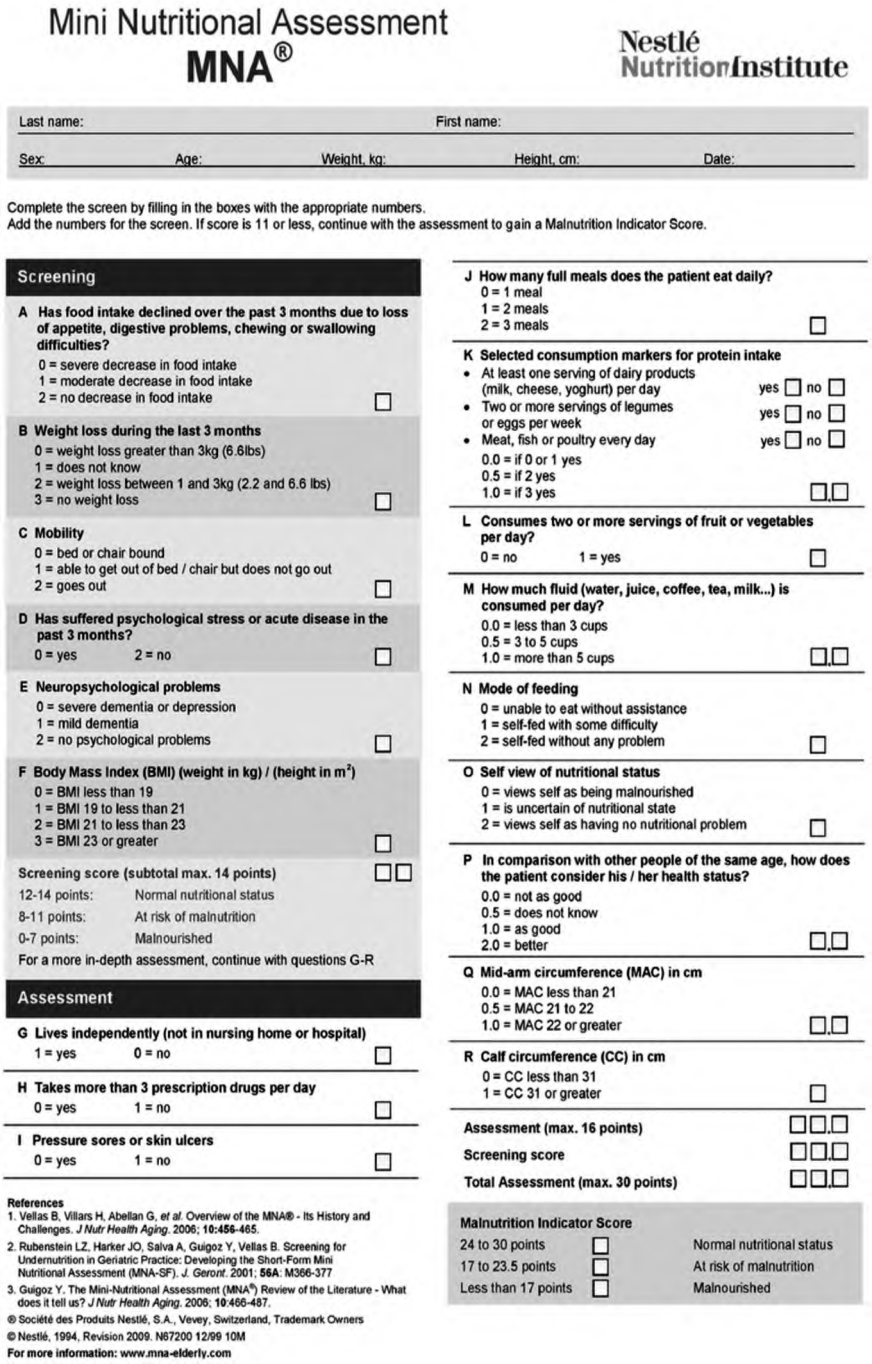
The Clinical Frailty Scale (CFS) was introduced in the second clinical examination of the Canadian Study of Health and Aging (CSHA) as a way to summarize the overall level of fitness or frailty of an older adult after they had been evaluated by an experienced clinician **[22]**.

The sarcopenia assessment was performed. Body muscle mass was measured using a bio-electrical impedance analysis machine (OMRON BF511 {HBF-511T-E}). The skeletal muscle index was then calculated as body muscle mass / height ^{2}. Six-meter gait speed was calculated bymeasurement of the average time taken for the subject to walk along a straight distance of six meters at usual walking speed. Six-meter gait speed reflects muscle performance. Handgrip strength was measured twice on each hand, using a hand grip dynamometer. To diagnose sarcopenia, European Work Group for Sarcopenia (EWGSOP) criteria was used **[1]**. There should be low muscle strength (hand grip strength <30kg in males and <20kg in females), low muscle

mass (skeletal muscle index <8.87kg/m^2 in males & <6.42kg/m^2 in females) and low physical performance (six meter gait speed <0.8m/s) **[1]**.

Statistical analysis:

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Data was summarized using mean and standard deviation for quantitative variables and frequencies (number of cases) and relative frequencies (percentages) for categorical variables. Comparisons between groups were done using unpaired *t*-test in normally distributed quantitative variables while non-parametric Mann-Whitney test was used for non-normally distributed quantitative variables. For comparing categorical data, Chi square (χ^2) test was performed. Exact test was used instead when the expected frequency is less than 5. *p*-values less than 0.05 were considered as statistically significant.



Mini Nutritional Assessment
MNA®

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake

B Weight loss during the last 3 months
0 = weight loss greater than 3kg (6.6lbs)
1 = does not know
2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)
3 = no weight loss

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems

F Body Mass Index (BMI) (weight in kg) / (height in m^2)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater

Screening score (subtotal max. 14 points)
12-14 points: Normal nutritional status
8-11 points: At risk of malnutrition
0-7 points: Malnourished
For a more in-depth assessment, continue with questions G-R

Assessment

G Lives independently (not in nursing home or hospital)
1 = yes 0 = no

H Takes more than 3 prescription drugs per day
0 = yes 1 = no

I Pressure sores or skin ulcers
0 = yes 1 = no

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals

K Selected consumption markers for protein intake
- At least one serving of dairy products (milk, cheese, yoghurt) per day yes no
- Two or more servings of legumes or eggs per week yes no
- Meat, fish or poultry every day yes no

0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes

L Consumes two or more servings of fruit or vegetables per day?
0 = no 1 = yes

M How much fluid (water, juice, coffee, tea, milk...) is consumed per day?
0.0 = less than 3 cups
0.5 = 3 to 5 cups
1.0 = more than 5 cups

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem

O Self view of nutritional status
0 = views self as being malnourished
1 = is uncertain of nutritional state
2 = views self as having no nutritional problem

P In comparison with other people of the same age, how does the patient consider his / her health status?
0.0 = not as good
0.5 = does not know
1.0 = as good
2.0 = better

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC 22 or greater

R Calf circumference (CC) in cm
0 = CC less than 31
1 = CC 31 or greater

Assessment (max. 16 points)
Screening score
Total Assessment (max. 30 points)

Malnutrition Indicator Score

24 to 30 points	Normal nutritional status
17 to 23.5 points	At risk of malnutrition
Less than 17 points	Malnourished

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For more information: www.mna-elderly.com

Fig. (1): Mini-Nutritional Assessment questionnaire.

Mini-Mental State Examination (MMSE)

Patient's Name:_____ Date:_____

Instructions: Ask the questions in the order listed.
Score one point for each correct response within each question or activity.

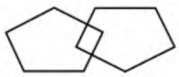
Maximum Score	Patient's Score	Questions
5		"What is the year? Season? Date? Day of the week? Month?"
5		"Where are we now: State? County? Town/city? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible. Number of trials:_____
5		"I would like you to count backward from 100 by sevens." (93, 86, 79,72, 65, ...) Stop after five answers. Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)
1		"Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.) 
30		**TOTAL**

Fig. (2): Mini-Mental State Examination (MMSE).

Patient Name:_____ **Date:**_____
Patient ID #_____

Katz Index of Independence in Activities of Daily Living

Activities Points (1 or 0)	Independence (1 Point) **NO** supervision, direction or personal assistance.	Dependence (0 Points) **WITH** supervision, direction, personal assistance or total care.
BATHING Points: _____	**(1 POINT)** Bathes self completely or needs help in bathing only a single part of the body such as the back, genital area or disabled extremity.	**(0 POINTS)** Need help with bathing more than one part of the body, getting in or out of the tub or shower. Requires total bathing
DRESSING Points: _____	**(1 POINT)** Get clothes from closets and drawers and puts on clothes and outer garments complete with fasteners. May have help tying shoes.	**(0 POINTS)** Needs help with dressing self or needs to be completely dressed.
TOILETING Points: _____	**(1 POINT)** Goes to toilet, gets on and off, arranges clothes, cleans genital area without help.	**(0 POINTS)** Needs help transferring to the toilet, cleaning self or uses bedpan or commode.
TRANSFERRING Points: _____	**(1 POINT)** Moves in and out of bed or chair unassisted. Mechanical transfer aids are acceptable	**(0 POINTS)** Needs help in moving from bed to chair or requires a complete transfer.
CONTINENCE Points: _____	**(1 POINT)** Exercises complete self control over urination and defecation.	**(0 POINTS)** Is partially or totally incontinent of bowel or bladder
FEEDING Points: _____	**(1 POINT)** Gets food from plate into mouth without help. Preparation of food may be done by another person.	**(0 POINTS)** Needs partial or total help with feeding or requires parenteral feeding.
TOTAL POINTS: _____	**SCORING:** 6 = High (*patient independent*) 0 = Low (*patient very dependent*	

Fig. (3): Katz Index **[21]**.

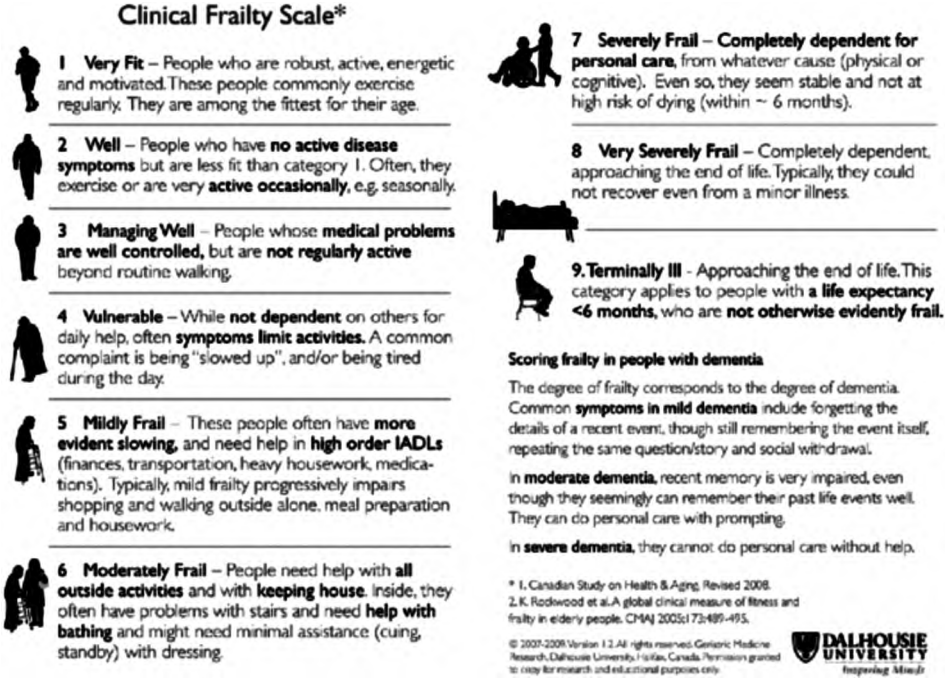


Fig. (4): Clinical Frailty Scale **[22]**.

Results

Data were extracted from 51 females (59.3%) and 35 males (40.7%) and their age ranged from 60-89 years, with a mean age of years 64.42 (±4.99 SD). BMI ranged from a minimum of 19.5Kg/m^2 to a maximum of 45 Kg/m^2 with a mean of 30.46 (±5.28Kg/m^2 SD). The participants socio–demographic, anthropometric measures, sarcopenia assessment tools, geriatrics' assessment tools,their biochemical parametersare summarized in (Table 1).

94.2% of the cases had low muscle strength, 32.6% had low muscle mass, & 58.1% had poor physical performance, (Fig. 5), corresponding to 81, 28 & 50 cases respectively. (Fig. 6) show the results of the Mini-Nutritional Assessment (MNA) among the studied cases. 12 cases were normal, 61 cases had risk for malnutrition & 13 cases were malnourished which reflects 14.0%, 70.9%, 15.1% of the studied population respectively. The prevalence of sarcopenia was 24.4% which accounts for 21 cases (Fig. 7).

A statistically non-significant correlations were obtained between age, (p-value=0.720), weight (p-value=0.074), waist circumference (p-value =0.210), hip circumference (p-value=0.103) and sarcopenia. The mean height in subjects who had sarcopenia was 1.66±0.11 meters , while in subjects who didn't have sarcopenia was 1.60±0.08 meters; hence there was a statistically significant correlation between height and sarcopenia (p-value=0.019)* (Table 2). There is a statistically significant positive correlation between BMI and sarcopenia (p-value <0.001 * *); the mean BMI in the studied population who had sarcopenia was 26.96±4.61kg/m^2; while in the population who didn't have sarcopenia was 31.59±5.00kg/m^2 (Table 2).

Amongst the 21 elderly with sarcopenia in our study, 5 had well controlled HbA1C level, 5 were fairly controlled while 11 were poorly controlled, accounting for 23.8%, 23.8% & 54.2% respectively. In the subjects who didn't have sarcopenia, 17 had good controlled HBA1C level, 9 were fairly controlled and 39 were uncontrolled, reflecting 26.2%, 13.8% & 60.0% respectively. The mean HbA1C level of the cases that had sarcopenia was 8.61±2.54 and the subjects who didn't have sarcopenia the mean level was 8.62±2.47. There was no statistically significant correlation between HBA1C level and sarcopenia (p-value=0.995) (Table 2). Similarly, correlation between lipid profile and sarcopenia showed statistically non-significant correlations between HDL-C, LDL-C, TGs and sarcopenia (p-value=0.421, p-value=0.196 and p-value=0.053 respectively). In our study, we found statistically non-significant correlations between MNA, MMSE, Katz index, frailty score and sarcopenia in the studied geriatric population (p-value=0.083, p-value=0.493, p-value=0.329 and p-value=0.898) respectively.

In our study 35 males were included, 16 of them had sarcopenia (45.7%) and 19 didn't have sarcopenia (54.3%). On the other hand, 51 females

were included, 5 of whom had sarcopenia (9.8%) and 46 didn't (90.2%). Strong positive correlation was obtained between sarcopenia and gender variation (p-value <0.001**) (Table 3).

The therapeutic lines of treatment included either oral anti-diabetics (52.3%) or insulin (32.6%) or both (15.1%). 55.8% of which (48 patients) suffered from diabetes microvascular complications (diabetic nephropathy, neuropathy, retinopathy) & macro-vascular complications (coronary heart disease and peripheral vascular disease), on the other hand 44.2% (38 patients) didn't experience diabetes complications. 53.5% of the studied cases had associated co-morbidities (hypertension, dyslipidemia, ischemic heart disease) while 46.5% didn't. Statisticallyinsignificant correlations were obtained between diabetes treatment, diabetes complications, associated co-morbidities and sarcopenia (p-value=0.378, p-value=0.716 and p-value=0.907) respectively. In addition, no statistically significant correlation was found between the different treatment modalities (OAD, insulin or both) and sarcopenia in our study. (Table 3).

Table (1): The socio-demographic, anthropometric measures, sarcopenia assessment tools, geriatrics' assessment tools, biochemical parameters among the studied cases.

Variables	(Mean±SD)
Age (years)	64.42±4.99
Diabtes duration (years)	13.70±7.60
Weight (kg)	79.17±13.14
Height (m)	1.62±0.09
BMI (kg/m^2)	30.46±5.28
Waist circumference (cm)	110.41±11.67
Hip circumference (cm)	118.35±10.78
Muscle Mass (kg)	21.50±4.46
Skeletal muscle index (kg/m^2)	8.21±1.34
Hand grip strength (kg)	17.50±5.86
Six-meter gait speed (m/sec)	0.79±0.22
HBA1C (%)	8.62±2.47
HDL-C (mg/dL)	46.76±18.67
LDL-C (mg/dL)	112.14±47.17
TG (mg/dL)	165.80±88.36
MNA	20.87±2.71
MMSE	29.44±0.63
Katz index	5.99±0.11
Frality score	3.31±0.79

SD : Standard deviation.
BMI : Body mass index.
HbA1c : Hemoglobin A1c.
HDL-C : High density lipoprotein cholesterol.
LDL-C : Low density lipoprotein cholesterol.
TG : Triglycerides.
MNA : Mini Nutritional Assessment.
MMSE : Mini-Mental State Examination.

Table (2): Correlation between demographic data, anthropometric measures, geriatrics' assessment tools, biochemical parameters and sarcopenia among the studied cases.

Variables	Yes (Mean±SD)	No (Mean±SD)	p-value
Age (years)	64.86±6.92	64.28±4.25	0.720
Diabetes-duration (Years)	11.82± 6.59	14.21±7.82	0.267
Weight (kg)	74.71±13.69	80.61±12.73	0.074
Height (m)	1.66±0.11	1.60±0.08	0.019*
BMI (kg/m^2)	26.96±4.61	31.59±5.00	<0.001**
Waist-circumference (cm)	107.62±12.86	111.31±11.21	0.210
Hip circumference (cm)	115.01±11.19	119.43±10.51	0.103
Muscle Mass (kg)	20.41±4.33	21.85±4.48	0.198
HBA1C (%)	8.61±2.54	8.62±2.47	0.995
HDL-C (mg/dL)	48.48±19.51	46.20±18.51	0.421
LDL-C (mg/dL)	96.33±39.94	117.25±48.46	0.196
TG (mg/dL)	140.62±80.87	173.94±89.73	0.053
MNA	19.98±3.01	21.15±2.57	0.083
MMSE	29.52±0.60	29.42±0.63	0.493
Katz index	5.95±0.22	6.00±0.00	0.329
Frality score	3.33±0.91	3.31±0.75	0.898

SD : Standard deviation.
BMI : Body mass index.
HbA1c : Hemoglobin A1c.
HDL-C : High density lipoprotein cholesterol.
LDL-C : Low density lipoprotein cholesterol.
TG : Triglycerides.
MNA : Mini Nutritional Assessment.
MMSE : Mini-Mental State Examination.
*p-value <0.05 Significant.
**p-value <0.001 Highly Significant.

Table (3): Correlation between sarcopenia, gender variation, diabetes treatment, diabetes complications, other comorbidities and MNA.

Variables	Sarcopenia				p-value
	Yes		No		
	Count	Row N %	Count	Row N %	
Sex:					
Male	16	45.7%	19	54.3%	<0.001**
Female	5	9.8 %	46	90.2%	
Diabetes treatment:					
Insulin	5	17.9%	23	82.1%	0.378
Oral antidiabetic drugs	14	31.1%	31	68.9%	
Insulin+OADs	2	15.4%	11	84.6%	
Diabetes complications:					
Yes	11	22.9%	37	77.1%	0.716
No	10	26.3%	28	73.7%	
Other comorbidities:					
Yes	11	23.9%	35	76.1%	0.907
No	10	25.0%	30	75.0%	
MNA:					
Normal	3	25.0%	9	75.0%	0.136
Risk for malnutrition	12	19.7%	49	80.3%	
Malnourishment	6	46.2%	7	53.8%	

MNA: Mini Nutritional Assessment.
OAD: Oral antidiabetic drugs.
* p-value <0.05 Significant.
**p-value <0.001 Highly Significant.

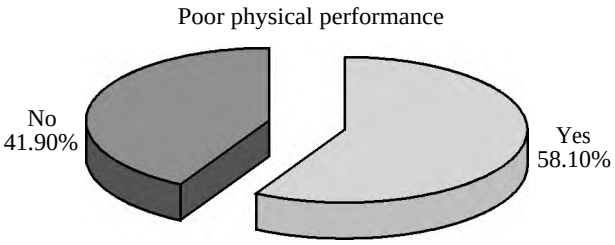


Fig. (5): Pie chart showing the distribution of "poor physical performance " between the studied population.

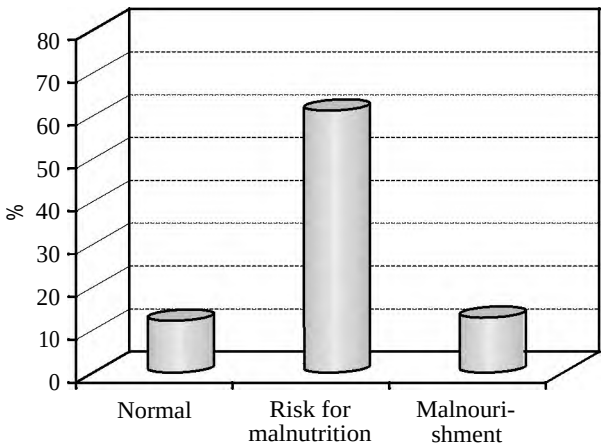


Fig. (6): Bar chart showing the different categories of MNA among the studied population.

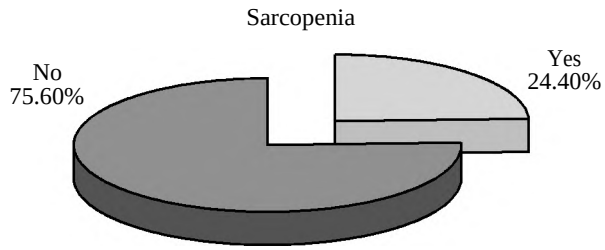


Fig. (7): Pie chart showing distribution of sarcopenia among the geriatric population.

Discussion

Sarcopenia is one of the geriatric syndromes that contribute to disability and increased mortality. The etiology of sarcopenia is multi-factorial including related changes in the mus culo skeletal, cellular and tissue structure and function. Both sarcopenia and diabeteshave similarpredisposing factors as skeletal muscle dysfunction. Therefore, we aimed in this study to identify prevalence of sarcopenia in older Egyptian patients with T2DM. Understanding the association of diabetes control in a vulnerable older population will influence the allocation of healthcare resources to scale up sarcopenia screening and facilitate the design of interventions to prevent further deterioration of muscle strength and function.

Amongst the 86 subjects, 24.4% (21 cases) had sarcopenia according to the European Work Group for Sarcopenia in Older People (EWGSOP) criteria. The percent of the studied population with low muscle mass, low muscle strength and low gait speed were 94.2, 32.6 and 58.1% respectively. The mean skeletal muscle index was 8.21±1.34kg/m^2; mean gait speed was 1.0±0.2m/s and mean grip strength was 17.50±5.86 kilograms. This was consistent with the study conducted in Singapore by Fung et al., among 387 unassisted ambulatory patients aged 60-89 years with T2DM, which showed that the overall prevalence of sarcopenia was 27.4%, the mean muscle mass was 6.3± 1.2kg/m^2, mean gait speed was 1.0±0.2m/s and mean grip strength was 25.5±8.1kg. The proportion with low muscle mass, low muscle strength and low gait speed were 57.9, 31.3 and 9.6% respectively **[16]**.

Our study's results seem lower compared with a Malaysian study by Norshafarina et al., conducted on 388 subjects of 60 years and above, revealed a percentage of 59.8% of sarcopenia and applied the EWGS diagnostic criteria and cut-off values for sarcopenia **[23]**. The prevalence of sarcopenia among people with T2DM in Korea was reported by Kim et al., to be 15.7% **[24]**. However, in the Korean study, sarcopenia was determined by the muscle mass measured using the dual-energy X-ray absorptiometry [DEXA], which identified muscle mass but not muscle strength to define sarcopenia. The variation in the prevalence could be attributed to the ethnic and demographic variables and the different tools used to determine sarcopenia. Never the less, the revised EWGSOP guideline in 2018 recommends the use of low muscle strength as the primary parameter for sarcopenia as it is the most reliable measure of muscle function.

A meta-analysis conducted by Chung et al., to investigate prevalence of sarcopenia with and without diabetes revealed The prevalence of sarcopenia was 15.9% in diabetics and 10.8% in non-diabetics **[25]**. A systemic review done by Ai et al. concluded that sarcopenia was frequent in T2DM, elder age and chronic hyperglycemia **[26]**.

In the current study, we found that prevalence of sarcopenia was 45.7% among males, while in females it was 9.8%.Strong positive correlation was obtained between sarcopenia and gender variation (p-value <0.001). This was consistent with the study conducted by Sazlina et al., who conducted a study involving 506 adults visiting primary care clinics in Malaysia with T2DM aged 60 years, that showed that male gender was associated

with sarcopenia (OR=1.84, 95% CI=1.12, 3.02, p=0.017) [4].

The fact that male sex is considered as a risk factor for sarcopenia was emphasized by Kim et al., who reported that men with T2DM had decreased lean body mass as compared to men without T2DM with similar body weight [24]. In addition Janssen I. explained that men lost greater muscle mass with advanced age compared to women, even though men have greater skeletal muscle mass [27]. In the contrary, Liu et al., in Taiwan, conducted on elderly subjects showed that the prevalence of sarcopenia among men and women (mean age 65 years) was 9.4% and 9.8%, respectively [28].

In our study, there is a statistically significant positive correlation between BMI and sarcopenia (p-value <0.001). This was supported by Fung et al., who found that the lower BMI was associated with lower risk of sarcopenia [16]. However, this was not supported by Sazlina et al., who found that being overweight/obese were less likely to be associated with sarcopenia (OR=0.09; 95%CI= 0.05, 0.16; p<0.001) [4].

In the current study, there was no statistically significant correlation between HBA1C and sarcopenia (p-value=0.995); the mean HBA1C level of the cases who had sarcopenia was 8.61±2.54 and the subjects who didn't have sarcopenia the mean level was 8.62±2.47. This was supported by Fung et al., who found that HbA1C (OR=0.81, 95%CI =0.63-1.04, p=0.093) was not associated with sarcopenia [16]. Similarly, Murata et al., reported that HbA1C wasn't statistically correlated to sarcopenia (p=0.789) according to their study that was conducted on elderly Japanese outpatients with type 2 diabetes mellitus (65 years old) [29]. A possible explanation can be that a single glycated hemoglobin index reflects the glycemic control over 3 months, which is probably too short to impact on the development of sarcopenia.

In our study, there was non-statistically significant correlation between lipid profile and sarcopenia; HDL-C, LDL-C, TGs and sarcopenia (p-value=0.421, p-value=0.196 and p-value=0.053 respectively). This was consistent with the study done by Fung et al., who found HDL-C, LDL-C, TGs and sarcopenia are not significantly correlated (p-value=0.07, p-value=0.18 and p-value=0.21 respectively) [16].

The Malaysian study by Norshafarina et al., showed that there was no significant correlation between LDL and sarcopenia (Crude OR0.817; 95% CI 0.376-1.775; p=0.610). However, high HDL level was significantly associated with incidence of sarcopenia (Crude OR0.523; 95% CI0.305-0.896; p=0.017) [23].

The current study showed that no statistically significant correlation was obtained between serum TSH level and sarcopenia (p-value=0.666). These results were supported by a study done by Sheng et al. on a total of 94 elderly Chinese to assess the association of thyroid function with sarcopenia in elderly Chinese. Sheng et al., found that TSH was not statistically correlated to sarcopenia (p-value =0.345) [30]. Another study by Choi et al., investigated the relationship between thyroid hormone levels and sarcopenia in elderly Koreans. It showed that TSH was not significantly associated with the risk of sarcopenia in males or females, whereas the fT4 concentration was associated with the risk of sarcopenia in both sexes [31].

In our study (which was conducted among 86 subjects), among the studied cases who had risk for malnutrition 19.7% (12 cases) had sarcopenia and 80.3% (49 cases) didn't and between the malnourished geriatrics, 6 cases had sarcopenia and 7 cases didn't; 46.2% & 53.8% respectively of the studied population.However, Liguori et al., studied risk of malnutrition and sarcopenia in geriatric population. 473 elderly subjects (mean age, 80.9± 6.6 years) were studied. Malnutrition risk was evaluated with Mini Nutritional Assessment (MNA) score, whereas muscle mass and muscle strength were evaluated by bio-impedentiometry and hand grip, respectively. Liguori et al., reported that theOverall prevalence of sarcopenia was 13.1 %, and it increased from 6.1% to 31.4% as MNA decreased (p<.001). MNA score was lower in elderly subjects with sarcopenia (15.4±4.2) than without sarcopenia (22.0±4.0) (p=.024) [32]. This discrepancy in the results between ours and Liguori et al., may be due to difference in the sample size of the study 86 versus 473 cases so it is highly recommended to conduct similar studies with larger number of studied subjects.

In our study, there is no statistically significant correlation between MNA, MMSE, Katz index, frailty score and sarcopenia in the studied geriatric population (p-value=0.083, p-value=0.493, p-value =0.329 and p-value=0.898) respectively. These geriatrics' assessment tools reflect nutritional status in elderly people, measure cognitive impairment, assess ability to do daily living activities and determine level of fitness or frailty of an older adult respectively.

Kim et al., conducted a longitudinal cohort study on the association of sarcopenia (assessed

by AWGS criteria) and cognitive impairment (MMSE score) which included 209 subjects. The study found the association of MMSE score with sarcopenia to be statistically significant (OR 2.67, 95% CI 1.72-4.16, p-value=0.007) **[33]**. Mental health is an important issue when it comes to customizing a treatment plan for the patient. The discrepancy in the results could be due to the difference in the mean age of the studied population and ethnic variation.

In our study, there is no statistically significant correlation between Katz index, frailty score and sarcopenia in the studied geriatric population (p-value=0.329 and p-value=0.898). However, Bu F et al., conducted a study on one thousand four hundred thirty six patients with diabetes. A total of 145 (10.9%) had frailty symptoms. Multivariate logistic regression analysis showed that marital status, activities of daily living, waist circumference, cognitive function, grip strength, social activity, and depression as predictors of frailty in people with diabetes. They constructed a comprehensive nomogram to evaluate the risk of frailty in patients with diabetes **[34]**.

Cacciatore et al., examined the predictive role of clinical frailty on long-term mortality in elderly subjects with and without diabetes. The study evaluated mortality after 12-year follow-up in 188 subjects with diabetes and 1,100 subjects without diabetes. They concluded that clinical frailty significantly predicts mortality in subjects without and even more in those with diabetes **[35]**.

The discrepancy in the results could be due to the difference in the sample size and ethnic variation.

Conclusions and recommendation:

The current study showed that the prevalence of sarcopenia among ambulatory Egyptian geriatric population aging 60 years and more was 24.4%. Male sex and BMI showed significant association with sarcopenia. HbA1C, lipid profile, TSH level was not significantly associated with sarcopenia. Different diabetes complications and different treatment modalities for diabetes showed no statistically significant association with sarcopenia. Certainly, further studies with larger population are needed to understand the potential of geriatric assessment tools, TSH level. This study may enable stratification of resource allocation for sarcopenia screening and intervention in this vulnerable group of older patients with T2DM.

Conflict of interest:

Authors declare no conflict of interest.

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انتشار الساركوبينيا بين المرضى المصريين المسنين المصابين بمرضى السكرى من النوع الثانى

السارکوبینیا (انخفاض کتلة العضلات) هی الخسارة المرضیة لکتلة العضلات، وهی مرتبطة بفقدان القوة والوظیفة للعضلات. یُذکر أن سارکوبینیا تؤثر علی ما یقرب من ١٠٪ من کبار السن وهذه الحالة علی غرار مرض السکری، ترتبط بالعدید من المضاعفات لدی کبار السن مثل الوفیات المبکرة والدخول المتکرر للحجز بالمستشفیات والعجز.

مرض السکری (DM) فی انتشار مستمر فی جمیع أنحاء العالم، ولا سیما فی کبار السن. ویرجع ذلک جزئیاً إلی زیادة متوسط الأعمار علی مستوی العالم بسبب التقدم فی علاج الأمراض المصاحبة لمرض السکری وجزئیاً بسبب زیادة عمر السکان وتحضر نمط الحیاة. خلال العقد الماضی، کان هناک اعتراف متزاید بالمضاعفات الأخری المتعلقة بمرض السکری مثل الضعف والسارکوبینیا التی أصبحت مجالات اهتمام البحث العلمی الجدید.

تم عمل هذه الدراسة بهدف تحدید مدی انتشار السارکوبینیا ومعرفة عوامل الخطر المرتبطة بها. تم تطوع المرضی للمشارکه فی هذه الدراسة فی العیادة الخارجیة لعیادة الأمراض الباطنة فی مستشفی القصر العینی.

تکونت مجموعة البحث من ٨٦ مریضاً مصریاً تتراوح أعمارهم بین ٦٠ و ٨٩ عاماً من المرضی الذین تم تشخیصهم بمرض السکری لمدة عام واحد الأقل، وقد تم علاجهم بأی وسیلة من وسائل علاج ارتفاع سکر الدم، بدءاً من التحکم فی النظام الغذائی وحدة أو العقاقیر التی تساعد علی تقلیل نسبة سکر الدم، أو حقن الأنسولین أو العقاقیر مع الأنسولین.

تم استبعاد الأشخاص الذین یعانون من أی أمراض تعیق تقییم السارکوبینیا ومثل السکتة الدماغیة، ومتلازمة النفق السرغی، وهشاشة العظام الشدیدة فی الورک أو الرکبة، وعسر الکلام، وصعوبات السمع، واستخدام مساعدات المشی، والإعاقات الجسدیة التی تؤثر علی قبضة الید أو المشی.

بعد الحصول علی الموافقة المکتوبة علی المشارکه فی البحث من المرضی المختارین ، تم عمل الآتی:

- ملء استمارة الدراسة من قبل الباحث لتحدید البیانات التالیة:

  مدة مرض السکری وطریقة علاجه التی یلتزم بها المریض.

  وجود مضاعفات مرض السکری أی اعتلال شبکی موثق، اعتلال الکلیة، اعتلال الأعصاب، أعتلال الأوعیة الدمویة.

- بعد ذلک، تم إجراء تقییم القیاسات البشریة لقیاس الوزن والطول ومؤشر کتلة الجسم (BMI) ومحیط الخصر ومحیط الورک.

- بعد ذلک، تم إجراء تقییم للسارکوبینیا:

١– تم قیاس کتلة عضلات الجسم باستخدام جهاز (OMRON BF511 HBF-511T-E). ثم تم حساب مؤشر العضلات الهیکلیة ککتلة عضلات الجسم مقسومة علی مربع ارتفاع الجسم.

٢– تم قیاس قوة قبضة الید مرتین فی کل ید، باستخدام مقیاس قوة قبضة الید جهاز (dynamometer hand grip).

٣– تم حساب سرعة المشی ستة أمتار بناءً علی قیاس متوسط الو قت الذی یستغرقه المریض للمشی لمسافة ستة أمتار بسرعة المشی المعتادة.

لتشخیص السارکوبینیا، تم استخدام معاییر مجموعة العمل الأوروبیة للسارکوبینیا (EWGSOP).

تم إجراء تقییم الشیخوخة للحالات فی هذه الدراسة بالأدوات التالیة:

- التقییم الغذائی المصغر (MNA).
- اختبار الحالة العقلیة المصغر (MMSE).
- مؤشر کاتز للاستقلال فی أنشطة الحیاة الیومیة (ADL).
- درجة الهشاشة الإکلینیکیة (Clinical Frailty score).

بالإضافة إلى ذلك، تم عمل التحاليل المعملية التالية للمرضى باستخدام محلل كيميائى آلى:

تم إجراء قياس السكر التراكمى (HbAIc) ونسبة الدهون أثناء الصيام كوليسترول البروتين الدهنى عالى الكثافة (HDL) وكوليسترول البروتين الدهنى منخفض الكثافة (LDL) والدهون الثلاثية (TG). كما أنه تم قياس هرمون (TSH) فى الدم.

تمت الموافقة على دراستنا البحثية من قبل لجنة أخلاقيات البحث الإكلينيكى بجامعة القصر العينى.

لقد درسنا العلا قة بين الساركوبينيا والمتغيرات المختبرة (العمر،الوزن،الطول، مؤشر كتلة الجسم، محيط الخصر، محيط الورك، مستوى الدهون الدم وHBA1C, TSH) بين الحالات المدروسة.

كما أننا درسنا العلاقة بين ساركوبينيا والأمراض المصاحبة المرتبطة به، ومدة مرض السكرى ومضاعفاته بين المرضى فى البحث. درسنا العلاقة بين ساركوبينيا وأدوات تقييم الشيخوخة (MNA, MMSE, Katz index & Scpre Frailty) بين الحالات المدروسة.

وجدنا أن ٢١ حالة (٢٤.٤٪) لديها ساركوبينيا تم تحديدها من قبل مجموعة العمل الأوروبية حول مرض الساركوبينيا فى كبار السن (EWGSOP). ارتبطت الساركوبينيا بشكل كبير مع جنس الذكور ($p<0.001$) لم يكن مؤشر التحكم فى نسبة السكر فى الدم مؤخراً (HbA1C) مرتبطاً بشكل كبير مع ساركوبينيا $p=0.995$.

سيؤدى الوعى بمدى انتشار ساركوبينيا بين المسنين فى مرافق الرعاية الصحية إلى تخصيص موارد الرعاية الصحية لتوسيع نطاق فحص ساركوبينيا وتسهيل تصميم التقنيات التى تساعد على منع المزيد من التدهور فى قوة العضلات ووظيفتها. بالإضافة إلى ذلك، يمكن إجراء تقييم ساركوبينيا فى مراكز الرعاية الصحية الأولية ليس فقط فى المستشفيات والمراكز الصحية الكبرى.