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ORIGINAL RESEARCH ARTICLE

The Prevalence of Sarcopenia and its Associated Risk Factors in Older Emirati Adults with Type 2 Diabetes Attending Dubai Health Diabetes Centre in Dubai, United Arab Emirates. A Cross-Sectional Study

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Abstract

Introduction: Sarcopenia has been shown to be increasingly prevalent among older adults with type 2 diabetes, contributing to increased susceptibility to mobility issues, falls, frailty, and poor health outcomes. Despite the growing burden of diabetes and ageing in the United Arab Emirates, there is no data available in the literature examining sarcopenia or reduced muscle mass in this population. Therefore, this study aimed to investigate the prevalence of sarcopenia and its associated risk factors in older Emirati adults with type 2 diabetes.

Methods: A total of 235 adults aged 60 years and above attending the Dubai Health Diabetes Centre were included in this study. Sarcopenia was screened via the SARC-F questionnaire and measurement of calf circumference and was identified based on a reduced fat-free mass index (FFMI), reduced muscle strength, and reduced physical performance. Clinical and biochemical parameters, nutritional status (MUST), and physical activity (GSLTPAQ) data were also collected. Statistical analyses included descriptive analyses and regressions.

Results: The prevalence of sarcopenia in our study population was found to be 23.8% and was significantly associated with older age, lower BMI and smaller waist circumference, longer duration of diabetes, poorer balance performance, higher vitamin D levels, and increased risk of malnutrition. Only age and smaller waist circumference retained statistical significance in the multivariate analysis.

Conclusion: Sarcopenia is a significant but under recognized condition among older Emirati adults with T2DM. Multidisciplinary strategies targeting nutrition and resistance training are essential to reduce functional decline and optimize diabetes management in this population.

Keywords

Sarcopenia, Grip strength, Hemoglobin A1c, Physical performance, Muscle mass, Malnutrition

Abbreviations

GSLTPAQ: Godin Shephard Leisure-Time Physical Activity Questionnaire; MUST: Malnutrition Universal Screening Tool; BIA: Bioelectric Impedance Analysis; AWGS: Asian Working Group for Sarcopenia; FFMI: Fat Free Mass Index; GLP-1RA: Glucagon-Like peptide-1 Receptor Agonist; ASMI: Appendicular Skeletal Muscle Mass Index; DEXA: Dual-Energy X-ray Absorptiometry



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Background

Sarcopenia is a common age-related condition characterized by the progressive loss of muscle mass, strength, and physical performance. This condition represents a core component of geriatric syndrome and is closely linked to frailty, increased susceptibility to falls, fractures, and disability, loss of independence, and even a greater risk of mortality [1]. Muscle mass and strength are crucial for enhancing physical function, reducing the risk of falls and fractures, and improving quality of life, particularly in the aging population [2]. Skeletal muscle is a primary tissue responsible for glucose uptake and utilization, playing a key role in insulin sensitivity. Therefore, preserving and enhancing muscle mass is crucial for optimizing glycemic control and supporting diabetes prevention and management [3].

The prevalence of sarcopenia is increasing due to the growing population of older adults globally and is more common among individuals with diabetes compared to those without diabetes [4]. According to Sravya et al [4], the prevalence of sarcopenia among community dwelling older adults ranges between 9.9% to 40%, whereas among the elderly with type 2 diabetes, it ranges between 15% to 44% [4].

Insulin resistance and elevated blood glucose levels contribute to accelerated muscle loss, resulting in a decline in strength, muscle mass, and physical function in older adults with diabetes. Weaker handgrip strength and reduced muscle mass are found in patients with both type 1 and type 2 diabetes [5]. In the United Arab Emirates (UAE), the prevalence of diabetes among older adults is notably high, with estimates ranging between 12.3% and 25.1% [6].

According to a 2024 UNFPA Arab States report, the number of persons aged 60 and above in the UAE are expected to increase more than six-fold between 2020 and 2050, from approximately 311,000 to over 2 million (rising to over 19% of the population) [7]. Research among older Emirati citizens utilizing primary healthcare services revealed a high prevalence of frailty (47%), often linked with sarcopenia [8]. Sarcopenia is a significant issue in the UAE, with research reporting prevalence of 10% in hospitalized older adults [9]. Ultimately, the consequences of frailty and sarcopenia are significant, leading to increased healthcare costs, higher utilization of resources, longer hospital stay, greater caregiver burden, reduced quality of life for older adults [10]. Hence, it is crucial to urgently address health and care issues among older adults to prevent adverse health outcomes in this population [11].

To date, there is limited population-based evidence examining sarcopenia among older adults in the United Arab Emirates. The primary aim of this study was to assess the prevalence of sarcopenia and its associated risk factors among Emirati populations. Recent studies

have emphasized the importance of early detection and intervention, including the use of dual-energy X-ray absorptiometry (DEXA) or bioelectrical impedance analysis (BIA) and strategies to improve the physical performance and muscle strength of older patients with type 2 diabetes [12]. Given that BIA may be more effective in reflecting the metabolic aspects of sarcopenia, this study aimed to address the gaps present in literature. We also aimed to determine whether low muscle mass, reduced strength, and poor physical performance are associated with glycemic control in older Emirati individuals with type 2 diabetes.

Methods

Study subjects and procedures

Patients aged 60 years or above with established type 2 diabetes attending their clinic appointment were recruited for the study. Individuals who met the inclusion criteria and provided informed consent were included. To be eligible for inclusion in the study, patients had to be aged 60 years or older and able to comprehend and collaborate when completing questionnaires and performing the required assessments. Study exclusions included patients with any severe cognitive or physical impairment, advanced or severe diabetes-related complications, metallic implants or electronic devices that interfere with BIA measurements, ongoing chemotherapy or radiation therapy for cancer, and incomplete medical records. This cross-sectional study was carried out at the Dubai Health Diabetes Centre in Dubai, UAE, between October 2024 and March 2025. Ethical approval was obtained from the Institutional Review Board (IRB) at Dubai Health (DSREC-09/2024_04). All participants were fully informed about the study objectives and pertinent safety measures, and written informed consent was obtained prior to participation.

Sample size calculation

Primary outcome variable: presence/absence of sarcopenia

In line with our aim to determine the prevalence of sarcopenia among older Emirati adults with type 2 diabetes, a cohort study of hospitalized acutely ill older patients in the UAE found the prevalence of sarcopenia to be 10% [9].

Formula for sample size calculation for estimating sarcopenia in patients with type 2 diabetes:

$$n = 15.4 * p * (1-p) / W^2$$

n = sample size

p = expected proportion (in this case, 0.10)

W = width of confidence interval (CI) (in this case 0.10)

$$N = 15.4 * 0.1 * (0.9) / 0.10^2 = 139$$

To obtain a 95% CI of $\pm 5\%$ and prevalence estimate of 10%, the sample size was calculated to be 139 patients.

Assessment of sarcopenia

In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) established the first consensus definition and diagnostic criteria for sarcopenia, emphasizing both low muscle mass and low muscle function (strength or performance) [13]. Following this, the Asian Working Group on Sarcopenia (AWGS) developed specific clinical algorithms and cut-off points for screening and diagnosing sarcopenia in Asian populations [14]. These definitions have been utilized worldwide to improve the understanding of the role of skeletal muscles in health and disease. In 2018, the group updated its consensus (EWGSOP2), recognizing sarcopenia primarily as a muscle disease (muscle failure) characterized by low muscle strength, reduced muscle quantity or quality, and poor physical performance [15].

Sarcopenia screening

In this study, sarcopenia was screened via the SARC-F questionnaire and calf circumference measurement. Calf circumference was measured at the widest part of the dominant leg using a non-stretchable tape. A calf circumference of less than 34 cm for men and less than 33 cm for women, combined with a SARC-F score of 4 or higher, was considered indicative of low muscle mass and sarcopenia [14].

Muscle strength measurement

The handgrip strength of the dominant hand was assessed using an electronic hand dynamometer, a valid device for measuring handgrip strength in older adults [16]. The participants were instructed to exert their maximum effort; a maximum of three attempts was made, with the highest value recorded for our study.

Physical performance measurement

Physical performance was assessed using two assessments: the five-time sit-to-stand test (FTSST) and the four-stage balance test. Due to space limitations in our clinic, the FTSST was utilized as a surrogate for gait speed or walking test, as supported by previous studies for sarcopenia diagnosis [17]. We applied the Asian Working Group for Sarcopenia (AWGS) 2019 recommendation in our study, using a 5-time chair stand time of ≥ 12 seconds to indicate low physical performance [14]. The four-stage balance test requires maintaining four increasingly challenging positions (feet together, semi-tandem, tandem, and single leg) for 10 seconds each. Inability to hold the semi-tandem stance for 10 seconds was considered an indicator of high fall risk and muscle weakness associated with sarcopenia.

Body composition measurement

A multifrequency bioelectric impedance analysis (BIA) device (SECA mBCA 514/512) was used to measure muscle mass. The fat-free mass index (FFMI), defined as the whole-body fat-free mass divided by height in

square meters (kg/m^2), was used to diagnose low muscle mass instead of skeletal muscle mass index (SMMI). We applied cutoff values of $< 17 \text{ kg}/\text{m}^2$ in men and $< 15 \text{ kg}/\text{m}^2$ in women, as recommended by the European Society of Clinical Nutrition and Metabolism (ESPEN) [18].

For our heterogeneous Emirati population, FFMI is preferred over SMMI for diagnosing low muscle mass because it utilizes established gender-specific cutoffs rather than population-specific reference values. While SMMI can be confounded by variations in regional muscle distribution, FFMI correlates strongly with BIA and DEXA-measured appendicular skeletal muscle mass index (ASMI) [19]. Consequently, FFMI offers a more robust, clinically relevant, and stable measure of overall lean tissue across diverse ethnic groups [20].

Physical activity and nutritional status assessment

The self-reported physical activity of the study participants was assessed using the adapted Arabic version of the Godin-Shephard Leisure-Time Physical Activity Questionnaire (GSLTPAQ) [21]. The GSLTPAQ classifies the study participants into three categories: sedentary, moderately active and active, based on their activity level.

The Malnutrition Universal Screening Tool (MUST) was used to identify patients who were malnourished, at risk of malnutrition (undernutrition) or obese. Three criteria are considered: current weight status (as measured by body mass index), unintentional weight loss, and the effects of acute disease that may result in a lack of nutritional intake for more than 5 days. Each parameter is scored on a scale from 0 to 2. Based on the total score, patients are classified as being at low (0), intermediate (1) or high (≥ 2) risk of malnutrition [22].

Sarcopenia definition

Sarcopenia was identified based on the following criteria: reduced FFMI (men: $< 17 \text{ kg}/\text{m}^2$; Women: $< 15 \text{ kg}/\text{m}^2$), reduced muscle strength (weak handgrip strength: men $< 28 \text{ kg}$; women $< 18 \text{ kg}$) and reduced physical performance (5-time chair stand test ≥ 12 seconds). Sarcopenia was diagnosed when low FFMI was present in combination with either reduced muscle strength or reduced physical performance [13,14].

Assessment of clinical parameters

All demographic data, including age, sex, duration of diabetes, medical history, medication records, comorbidities, presence of diabetes-related complications, cardiovascular disease, and history of bariatric surgery, were obtained from medical records.

Anthropometric measurements (height, weight, BMI, waist circumference, calf circumference, and body fat percentage) were measured and recorded during the study visit. Biochemical parameters, including hemoglobin A1c (HbA1c), microalbuminuria, serum creatinine, vitamin D levels, and lipid profiles, were

obtained from clinical records, with the most recent values used for analysis.

Statistical analysis

Prior to analysis, the data were double-entered and cross-checked for accuracy. Descriptive statistics, which display data by frequencies and percentages for categorical variables and by means and standard deviations for continuous variables, were used to describe the sociodemographic and clinical characteristics of the study sample. Multivariate logistic regression analysis was used to assess the determinants of sarcopenia among the study participants. Statistical significance was set at $p < 0.05$, with all tests being 2-sided. The Statistical Package for the Social Sciences (SPSS) software was used to analyze the data obtained.

Results

The demographic, anthropometric and lifestyle characteristics of the study participants are displayed in [table 1](#). Among the 235 participants included in the analysis, 56 (23.8%) were classified as having sarcopenia. Individuals with sarcopenia were significantly older than those without sarcopenia (68.32 ± 4.35 versus 65.64 ± 4.29 years; $p < 0.001$) and females predominated although sex distribution did not differ significantly between the groups ($p = 0.083$). There were significant differences observed in the anthropometric measures between the groups; whereby participants with sarcopenia had significantly lower BMI compared to those without sarcopenia. Similarly, waist and calf circumference were significantly lower in the sarcopenia

group with no significant differences in body fat ($p = 0.597$). Participants with sarcopenia were shown to be significantly more likely to be classified as high risk on the SARC-F screening tool (21.4% versus 9.5%; $p = 0.018$) and to have high risk of falling on the four-stage balance test (53.6% versus 30.7%; $p = 0.031$), indicating a higher prevalence of impaired balance in this group. Physical activity levels, as measured by the GSLTPAQ and prior bariatric surgery status, did not differ significantly between the groups.

The clinical characteristics of the participants are displayed in [table 2](#). Participants with sarcopenia had a significantly longer duration of diabetes compared with those without sarcopenia (21.75 ± 8.65 versus 18.20 ± 7.95 years, $p = 0.005$), suggesting a potential cumulative effect of chronic metabolic exposure on decline in muscle mass. Glycemic control however, as reflected by HbA1c levels, was comparable between groups ($p = 0.699$), indicating that current HbA1c may not fully represent long-term metabolic stress associated with sarcopenia. Malnutrition risk, as indicated by the Malnutrition Universal Screening Tool (MUST), was significantly more prevalent in the sarcopenia group (12.5% versus 3.9%, $p = 0.018$), suggesting that compromised nutritional status may be closely associated with muscle loss in older adults with type 2 diabetes. Lipid parameters (LDL-C, HDL-C, total cholesterol, triglycerides) and markers of renal involvement, including microalbumin-to-creatinine ratio and albuminuria status, did not differ significantly between groups (all $p > 0.05$). Similarly, the prevalence of microvascular and macrovascular

Table 1: Comparison of demographic, anthropometric and lifestyle characteristics between participants with and without sarcopenia.

Variable	Overall (n = 235)	Non-Sarcopenia (n = 179)	Sarcopenia (n = 56)	P value*
Age (years)	66.28 $\pm$ 4.44	65.64 $\pm$ 4.29	68.32 $\pm$ 4.35	< 0.001
Gender				
Female	172 (73.2%)	126 (70.4%)	46 (82.1%)	
Male	63 (26.8%)	53 (29.6%)	10 (17.9%)	0.083
Anthropometrics				
BMI (kg/m ²)	29.90 $\pm$ 5.67	31.23 $\pm$ 5.60	25.66 $\pm$ 3.31	< 0.001
Waist Circumference (cm)	93.20 $\pm$ 11.10	95.15 $\pm$ 10.85	87.00 $\pm$ 9.59	< 0.001
Calf Circumference (cm)	29.65 $\pm$ 4.33	30.55 $\pm$ 4.28	26.77 $\pm$ 3.07	< 0.001
% Body Fat	45.5 (37.5-49.8)	45.6 (36.05-50.1)	45.4 (39.7-48.55)	0.597
Muscle Mass, Strength and Performance				
SARC-F Score				
Low sarcopenia risk	206 (87.7%)	162 (90.5%)	44 (78.6%)	
High sarcopenia risk	29 (12.3%)	17 (9.5%)	12 (21.4%)	0.018
Four Stage Balance Test				
High fall risk	154 (65.5%)	124 (69.3%)	30 (53.6%)	
Low fall risk	81 (34.5%)	55 (30.7%)	26 (46.4%)	0.031
GSLTPAQ Score				
Active	13 (5.5%)	13 (7.3%)	0 (0.0%)	
Moderately Active	91 (38.7%)	66 (36.9%)	25 (44.6%)	
Sedentary	131 (55.7%)	100 (55.9%)	31 (55.4%)	0.094

*Chi-square analysis was carried out for the categorical variables (presented as number and percentage). Continuous variables with non-normal distribution are presented as median (interquartile range) and analyzed using the Mann-Whitney U test, while normally distributed continuous variables are presented as mean $\pm$ standard deviation and compared using independent samples t-tests. P value was significant at $p < 0.05$.

Table 2: Comparison clinical characteristics between participants with and without sarcopenia.

Variable	Overall (n = 235)	Non-Sarcopenia (n = 179)	Sarcopenia (n = 56)	P value*
Diabetes Duration (years)	19.04 ± 8.25	18.20 ± 7.95	21.75 ± 8.65	0.005
HbA1c (%)	7.46 ± 1.22	7.45 ± 1.27	7.52 ± 1.04	0.699
MUST Score				
No malnutrition	221 (94%)	172 (96.1%)	49 (87.5%)	
Risk of malnutrition	14 (6%)	7 (3.9%)	7 (12.5%)	0.018
Biochemistry				
LDL-C (mg/dl)	80.94 ± 32.70	81.03 ± 33.64	80.68 ± 29.82	0.945
HDL-C (mg/dl)	51.99 ± 12.78	51.55 ± 12.18	53.41 ± 14.77	0.346
Total Cholesterol (mg/dl)	156.61 ± 40.02	156.32 ± 40.47	157.54 ± 38.87	0.843
Triglycerides (mg/dl)	112 (83.0-148.5)	112 (83.0-147.5)	116 (86.5-152.5)	0.959
Creatinine Urine	65.9 (39.95-99.05)	67.3 (41.95-102.05)	51.45 (32.1-83.25)	0.038
Microalbumin/Creatinine ratio	12 (5.95-31.6)	11.3 (5.7-27.25)	16.8 (5.95-42.9)	0.316
Vitamin D (ng/mL)	40.64 ± 12.82	39.43 ± 13.20	44.49 ± 10.72	0.010
Diabetes Complications/Comorbidities				
Retinopathy				
Absence of Retinopathy	168 (71.5%)	126 (70.4%)	42 (75.0%)	
Presence of Retinopathy	67 (28.5%)	53 (29.6%)	14 (25.0%)	0.505
Neuropathy				
Absence of Neuropathy	201 (85.5%)	156 (87.2%)	45 (80.4%)	
Presence of Neuropathy	34 (14.5%)	23 (12.8%)	11 (19.6%)	0.207
Nephropathy				
Absence of Nephropathy	198 (84.3%)	151 (84.4%)	47 (83.9%)	
Presence of Nephropathy	37 (15.7%)	28 (15.6%)	9 (16.1%)	0.939
Urine Albumin				
Normoalbuminuria	178 (76.4%)	136 (76.8%)	42 (75.0%)	
Microalbuminuria	52 (22.3%)	38 (21.5%)	14 (25.0%)	
Macroalbuminuria	3 (1.3%)	3 (1.7%)	0 (0.0%)	0.547
Hypertension				
Absence of hypertension	69 (29.4%)	51 (28.5%)	18 (32.1%)	
Presence of hypertension	166 (70.6%)	128 (71.5%)	38 (67.9%)	0.601
Dyslipidemia				
Absence of dyslipidemia	6 (2.6%)	6 (3.4%)	0 (0.0%)	
Presence of dyslipidemia	229 (97.4%)	173 (96.6%)	56 (100.0%)	0.165
CVD				
Absence of CVD	216 (91.9%)	163 (91.1%)	53 (94.6%)	
Presence of CVD	19 (8.1%)	16 (8.9%)	3 (5.4%)	0.391
Glucose-lowering therapies				
GLP-1				
Not taking	128 (54.5%)	94 (52.5%)	34 (60.7%)	
Taking	107 (45.5%)	85 (47.5%)	22 (39.3%)	0.282
Insulin				
Not taking	168 (71.5%)	124 (69.3%)	44 (78.6%)	
Taking	67 (28.5%)	55 (30.7%)	12 (21.4%)	0.179
Bariatric Surgery				
No	231 (98.3%)	175 (97.8%)	56 (100.0%)	
Yes	4 (1.7%)	4 (2.2%)	0 (0.0%)	0.259
Sulfonylureas				
Not taking	141 (60.0%)	115 (64.2%)	26 (46.4%)	
Taking	94 (40.0%)	64 (35.8%)	30 (53.6%)	0.018
Biguanides				
Not taking	22 (9.4%)	17 (9.5%)	5 (8.9%)	
Taking	213 (90.6%)	162 (90.5%)	51 (91.1%)	0.899
TZD				
Not taking	216 (92.3%)	168 (93.9%)	48 (87.3%)	
Taking	18 (7.7%)	11 (6.1%)	7 (12.7%)	0.109
SGLT-2				
Not taking	33 (14.0%)	26 (14.5%)	7 (12.5%)	
Taking	202 (86.0%)	153 (85.5%)	49 (87.5%)	0.703
Meglitinides				
Not taking	225 (95.7%)	173 (96.6%)	52 (92.9%)	
Taking	10 (4.3%)	6 (3.4%)	4 (7.1%)	0.220

DPP4				
Not taking	149 (63.4%)	118 (65.9%)	31 (55.4%)	
Taking	86 (36.6%)	61 (34.1%)	25 (44.6%)	0.152
AGIs				
Not taking	231 (98.3%)	176 (98.3%)	55 (98.2%)	
Taking	4 (1.7%)	3 (1.7%)	1 (1.8%)	0.956

*Chi-square analysis was carried out for the categorical variables (presented as number and percentage). Continuous variables with non-normal distribution are presented as median (interquartile range) and analyzed using the Mann-Whitney U test, while normally distributed continuous variables are presented as mean $\pm$ standard deviation and compared using independent samples t-tests. P value was significant at $p < 0.05$.

Table 3: A multivariate logistic regression analysis assessing the determinants of sarcopenia among adults with diabetes.

Sarcopenia			
Variable	Beta	P value*	95% CI
Age	1.141	0.001	1.053-1.237
Diabetes Duration	1.040	0.090	0.994-1.088
Waist Circumference	0.911	< 0.001	0.875-0.948
MUST Score	2.903	0.124	0.746-11.30
HbA1c	1.015	0.922	0.751-1.372
Vitamin D	1.017	0.225	0.990-1.045
Creatinine Urine	0.997	0.462	0.989-1.005
Sulphonylurea	2.045	0.050	1.001-4.179

*Significant at $p < 0.05$

complications (including retinopathy, neuropathy, nephropathy, cardiovascular disease, hypertension, and dyslipidemia) was comparable. Urinary creatinine (a byproduct of muscle metabolism and an indirect marker of skeletal muscle mass) on the other hand, was significantly lower in participants with sarcopenia compared to those without sarcopenia (median 51.5 (32.1-83.3) versus 67.3 (42.0-102.1), respectively; $p = 0.038$). These findings suggest that sarcopenia in this cohort may be more closely linked to disease duration and nutritional vulnerability rather than overt differences in cardiometabolic risk profiles or complication burden. Vitamin D levels were modest but significantly higher among participants with sarcopenia ($p = 0.010$). The higher levels may reflect clinical correction via supplementation in individuals identified as frail or at risk as opposed to biological protection. Regarding glucose-lowering therapies, sulphonylurea use was significantly more common in the sarcopenia group (53.6% versus 35.8%, $p = 0.018$). This association may reflect longer-standing diabetes requiring insulin secretagogues, or potential weight-related prescribing patterns, rather than a direct causal effect. No significant differences were observed for other glucose-lowering agents, including GLP-1 receptor agonists, insulin, SGLT-2 inhibitors, or metformin.

A multivariate logistic regression analysis was performed to examine the factors that are independently associated with sarcopenia in adults with diabetes (Table 3). The model included clinical, functional, and biochemical variables to identify adjusted predictors of sarcopenia. Increasing age was significantly associated with higher odds of sarcopenia (OR = 1.141, 95% CI: 1.053–1.237, $p = 0.001$). In contrast, waist circumference was inversely associated with sarcopenia (OR = 0.911, 95% CI: 0.875–0.948, $p < 0.001$).

Sulphonylurea use demonstrated a borderline significant association with sarcopenia, with users having approximately twofold higher odds compared to non-users (OR = 2.045, 95% CI: 1.001-4.179, $p = 0.050$). No significant associations were observed between sarcopenia and diabetes duration, MUST score, HbA1c levels, vitamin D levels, or urinary creatinine.

Table 4 presents the results from a multiple linear regression analysis examining the associations between various participant characteristics and HbA1c levels. Unstandardized regression coefficients (B) with 95% confidence intervals were reported to allow clinical interpretation of effect sizes. Among the variables assessed, insulin use ($\beta = 0.175$, $p = 0.020$) and Vitamin D ($\beta = -0.019$, $p = 0.005$) were significantly associated with HbA1c levels. Insulin was positively associated with higher HbA1c, whereas higher vitamin D levels were associated with lower HbA1c. No significant associations were observed for age, sarcopenia, diabetes duration, calf circumference, poor balance, presence of retinopathy or neuropathy, HDL-C levels, SGLT2 inhibitor use, or dyslipidemia ($p > 0.05$).

Discussion

To our knowledge, this study was the first to investigate the prevalence of sarcopenia in older Emirati patients with type 2 diabetes, revealing a prevalence of 23.8%. This is significant given that frailty and related conditions are growing concerns within the community-dwelling older population in Abu Dhabi [8]. Both the SARC-F questionnaire and calf circumference (CC) measurement, utilizing the AWGS 2019 criteria [14], proved to be effective tools for screening and identifying those at substantial risk. These findings align with current international consensus reports

Table 4: Multiple linear regression analysis for the associations between participant characteristics and HbA1c.

HbA1c Adjusted R² = 0.128			
Variable	Beta (unstandardized coefficient)	P value*	95% CI
Age	-0.008	0.659	-0.049-0.029
Diabetes Duration	0.010	0.368	-0.012-0.033
Waist Circumference	0.003	0.682	-0.011-0.017
MUST Score	-0.100	0.765	-0.756-0.557
GLP-1	-0.250	0.196	-0.630-0.130
Insulin use	0.559	0.007	0.155-0.964
Retinopathy	0.021	0.907	-0.336-0.378
Neuropathy	0.346	0.129	-0.102-0.794
Nephropathy	0.039	0.858	-0.393-0.472
LDL-C	0.004	0.109	-0.001-0.009
HDL-C	-0.004	0.504	-0.016-0.008
Vitamin D	-0.018	0.005	-0.031- -0.006
Bariatric Surgery	-1.158	0.055	-2.342-0.027
Sulphonyl urea	0.306	0.063	-0.017-0.630
SGLT2	0.257	0.283	-0.215-0.730
Biguanides	-0.145	0.604	-0.695-0.405
TZDs	0.412	0.158	-0.161-0.985
DPP4	0.252	0.195	-0.130-0.635
Creatinine Urine	-0.001	0.489	-0.004-0.002
Sarcopenia	0.019	0.359	-0.022-0.060

*Significant at p < 0.05

which emphasize the use of validated screening tools to initiate the diagnostic pathway [15].

Sarcopenia is a leading contributor to poor balance and falls in older adults. Studies indicate that individuals with sarcopenia exhibit increased postural instability, often attributed to the overactivity of ankle dorsiflexors and reduced contraction of the gluteus maximus and rectus femoris muscles [23]. In our study, the 5-time chair stand test that is a validated surrogate for assessing physical performance [17] and the four-stage balance test revealed significant lower limb muscle weakness and poor balance in participants with sarcopenia. Our findings demonstrate that these individuals have an elevated risk of falling, aligning with the established link between lower limb strength and postural stability. Therefore, targeted multidisciplinary exercise interventions focusing on these specific lower extremity muscles are essential to improve balance and mitigate fall risk in this population [2,23].

Our study revealed that participants with sarcopenia were generally older, had a longer duration of diabetes, and presented with a lower BMI and smaller waist circumference. These findings align with previous research indicate that the risk of sarcopenia increases significantly with advanced age [1,4]. Furthermore, our results are consistent with studies by Sazlina et al. and Sravya et al., which identified longer diabetes duration, lower BMI, and reduced waist circumference as key risk factors in patients with type 2 diabetes [4,24].

Physical and functional decline associated with advanced age is intrinsically linked to reduced muscle

mass and strength [25]. Consistent with Sazlina, et al. [24], our findings indicate that a long mean duration of diabetes (19 years) is strongly associated with the presence of sarcopenia. Type 2 diabetes-related insulin resistance often results in a preferential loss of Type II (fast-twitch) muscle fibers, leading to reduced muscle power and endurance [3,25]. This impaired glucose uptake by skeletal muscle creates a metabolic environment that significantly accelerates the onset and progression of sarcopenia [3,25].

Lower BMI and smaller waist circumference are associated with increased odds of sarcopenia in type 2 diabetes, suggesting that in this cohort, sarcopenia may be linked to general undernutrition, illness-related catabolism, or frailty leading to lower overall body mass and strength [26]. This inverse relationship likely explains the higher prevalence of sarcopenia observed among participants with lower waist circumference in the present study. These results highlight a critical need for integrated nutritional screening protocols [22,27] and specialized assessment for the "malnutrition-sarcopenia syndrome" in older adults at risk [27].

In contrast to previous research [28], our findings did not show a significant association between poor glycemic control and the presence of sarcopenia or low muscle mass. This discrepancy may be attributed to the intensive anti-diabetes therapy utilized in our patient cohort, which prioritizes strict glucose management. While some studies identify poor glycemic control as a primary risk factor for sarcopenia [5], research also indicates that intensive management and polypharmacy

can effectively reduce HbA1c levels in older adults regardless of their muscle mass status [29,30].

Furthermore, other factors such as age, HDL-C, and the presence of complications failed to show significant associations with HbA1c. This underscores the multifactorial nature of glycemic control, which is influenced by a complex combination of clinical markers, patient behavior, nutrition, and treatment adherence [31].

Our findings demonstrate a significant correlation between elevated serum vitamin D levels and enhanced glycemic control, as evidenced by lower HbA1c values. This association is well-documented; research indicates that vitamin D may improve glucose homeostasis directly by activating receptors on pancreatic β -cells [32] or indirectly by regulating calcium homeostasis, a critical factor for insulin secretion and signaling [33]. While vitamin D deficiency is prevalent in type 2 diabetes patients, particularly those with suboptimal glycemic control [34], evidence suggests that consistent supplementation can reduce HbA1c and improve metabolic outcomes by mitigating insulin resistance and oxidative stress [35]. Considering this, all participants in our study routinely received vitamin D supplements and maintained their prescribed medication regimens throughout the study period.

Our findings revealed that urine creatinine levels and malnutrition risk were associated with sarcopenia in univariate analyses; however, this significance did not persist in the multivariate model, where age and waist circumference emerged as the strongest predictors. Despite losing independent predictive value, these markers remain clinically relevant. Urine creatinine serves as a useful surrogate marker for muscle mass, while malnutrition reflects the catabolic state underlying muscle loss [36]. The lack of independent significance in our multivariate model suggests that, in this population, structural sarcopenia is more accurately explained by age and waist circumference than by biochemical markers like creatinine, which can be influenced by renal function or daily protein intake [37]. Similarly, sulfonylurea use was associated with sarcopenia only in the univariate analysis. This aligns with earlier research suggesting that while sulfonylureas may have adverse effects on skeletal muscle, their impact may be secondary to other dominant clinical predictors [38].

This study has certain limitations that should be considered. Firstly, our study had a limited sample size, which may have introduced bias into the dependability of our findings due to increased variability. Nevertheless, our research was the first to evaluate the frequency of sarcopenia among older adults with diabetes in the Emirati population. Secondly, the cross-sectional design of the study and the absence of the evaluation of the development of sarcopenia and long-term glycemic

control, precludes establishing causal relationships between sarcopenia and the observed associations. Longitudinal studies could have been more helpful in assessing changes in muscle mass in relation to HbA1c variability, the combination of different medications with their corresponding doses, and the effects of physical activity and nutrition. Thirdly, although nutritional risk was evaluated using the Malnutrition Universal Screening Tool (MUST), this instrument does not provide detailed information on dietary protein quantity, quality, or distribution across meals. As a result, we were unable to directly examine the contribution of daily protein intake to the development or severity of sarcopenia. This limitation is especially relevant in older adults with type 2 diabetes, in whom anabolic resistance increases protein requirements. The lack of dietary data restricts mechanistic interpretation of the association observed between malnutrition risk and sarcopenia. Future studies incorporating daily protein intake assessment are warranted to more clearly define the nutritional determinants of sarcopenia in this population. Fourthly, physical activity behavior was assessed using the Godin Leisure Time Exercise Questionnaire (GLTEPAQ) which is an excellent, validated tool for measuring general physical activity (mild, moderate, and strenuous), however it does not specifically distinguish or quantify resistance or strength training, and this can affect muscle mass and strength. Lastly, our research was conducted within an older Emirati demographic group and aimed to explore the relationship between sarcopenia and type 2 diabetes in a context that differs from the environments of numerous prior studies. Our results may differ because our population has different ethnicities, body sizes, lifestyles, and cultures.

Conclusion

This study presented a sarcopenia prevalence of 23.8% among older Emirati adults with type 2 diabetes; with advanced age, lower BMI and reduced waist circumference being the main independent predictors. While the 5-time chair test and SARC-F questionnaire showed value as practical screening tools, FFMI proved to be a consistent and ethnically relevant measure for assessing low muscle mass within this population. Moreover, although intensive glycemic control and vitamin D supplementation may contribute to improved metabolic outcomes; however, they do not completely alleviate the risk of sarcopenia that is associated with prolonged diabetes duration and age-related functional decline. In addition, while biomarkers such as urine creatinine and nutritional risk scores continue to be clinically relevant indicators of catabolic status, they should be interpreted within a more comprehensive multidisciplinary framework. Healthcare professionals should prioritize integrated nutritional screening and assessment alongside targeted resistance-training

interventions in order to reduce the risk of falls and postural instability in this population. Longitudinal studies in the future are needed to further examine the effects of specific anti-diabetes therapies on muscle quality and long-term health outcomes among older adults in the UAE.

Declarations

Ethical Approval and consent to participate

This cross-sectional study was carried out at the Dubai Health Diabetes Centre in Dubai, UAE, from October 2024 to March 2025. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Institutional Review Board (IRB) at Dubai Health (DSREC-09/2024_04). Each participant signed an informed consent form before participating in the study.

Consent for publication

Not applicable.

Data availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Z. Younes participated in data collection, analysis, and interpretation, and critically revised the study protocol and article draft.

M. Abdalla assisted in participant's recruitment and data collection.

M. Farooqi reviewed the manuscript and provided helpful suggestions.

H. Hasan designed the study, wrote the protocol draft, performed the literature search, and authored the article draft.

All authors approved the last version of the article.

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