ENDOCRINOLOGY RESEARCH AND PRACTICE

SOCIETY OF ENDOCRINOLOGY AND METABOLISM OF TURKEY

Handgrip Strength as a Multidimensional Marker in Adults Living with Obesity

ORIGINAL ARTICLE
Endocrinol Res Pract. 2026;30(4):254-260

ABSTRACT

Objective: Dynapenia is increasingly recognized as a distinct clinical phenotype. However, its clinical significance in adults living with obesity, including its associations with psychological symptoms, cognitive function, and comorbidity burden, remains insufficiently characterized. This study aimed to evaluate the prevalence of dynapenia and its metabolic, psychological, and clinical correlates in adults living with obesity.

Methods: This cross-sectional study included 140 adults living with obesity recruited from a tertiary endocrinology clinic. Handgrip strength was measured using a digital dynamometer and categorized as weak (dynapenic), normal, or strong according to age- and sex-adjusted reference values. Body composition was assessed using bioelectrical impedance analysis. Cognitive function, depressive symptoms, comorbidity burden, and physical activity levels were evaluated using the AD8 Dementia Screening Interview, Beck Depression Inventory (BDI), Charlson Comorbidity Index (CCI), and International Physical Activity Questionnaire-Short Form (IPAQ-SF), respectively. Group comparisons were performed using non-parametric tests, and correlations were assessed using Spearman coefficients.

Results: Dynapenia was present in 20.0% of participants. Compared with strong individuals, those with dynapenia had higher body fat percentage, lower appendicular skeletal muscle mass index, and lower hemoglobin and creatinine levels (all $P < .01$). Dynapenia was also associated with a higher prevalence of hypothyroidism and a greater depressive symptom burden. Handgrip strength correlated positively with ASMI ($\rho = 0.320$, $P < .001$), creatinine ($\rho = 0.245$, $P = .004$), and hemoglobin ($\rho = 0.249$, $P = 0.004$), and negatively with body fat percentage ($\rho = -0.374$, $P < .001$) and BDI scores ($\rho = -0.181$, $P = .036$). No significant correlation was observed with AD8 scores. Higher CCI scores were associated with lower muscle strength.

Conclusion: Dynapenia is common among adults living with obesity and is associated with adverse body composition, reduced biochemical markers of muscle integrity, greater depressive symptom burden, and higher comorbidity burden. Handgrip strength represents a simple, rapid, and integrative clinical marker that may support early risk stratification in obesity care.

Keywords: Dynapenia, handgrip strength, obesity

Introduction

Dynapenia, defined as a reduction in muscle strength disproportionate to muscle mass, has emerged as a clinically meaningful phenotype distinct from sarcopenia.[1] Accumulating evidence indicates that muscle strength is a stronger predictor of disability, hospitalization, and mortality than muscle mass alone.[2-4] Accordingly, handgrip strength, a simple surrogate of global muscle function, is increasingly recognized as a robust biomarker of overall health.[5,6]

Obesity is now recognized as a systemic, chronic disease characterized by low-grade inflammation, insulin resistance, and impaired muscle quality, all of which contribute to functional decline despite relatively preserved muscle mass.[7,8] In this context, dynapenia may represent a more sensitive marker of functional impairment in individuals living with obesity than sarcopenia.[9] However, its metabolic, psychosocial, and behavioral correlates in this population remain insufficiently characterized.

Reduced muscle strength has also been associated with cognitive decline, depressive symptoms, and increased mortality.[10-15] However, data addressing these multidimensional associations in adults living with obesity—particularly in Mediterranean and Middle Eastern populations—remain limited.[16] Moreover, comorbidity burden has been implicated in muscle weakness,[17-19] while physical activity may modulate these functional outcomes. Besides,

Mehdi Erdem[1]
Saliha Yıldırım[2]
Safiye Kızışar Yılmaz[1]
Şerife Ezgi Doğan[1]
Bağdagül Yüksel[1]

[1]*Department of Endocrinology and Metabolism, Sincan Training and Research Hospital, Ankara, Türkiye*
[2]*Department of Nephrology, Sincan Training and Research Hospital, Ankara, Türkiye*

Corresponding author:
Mehdi Erdem,
✉ drmehdihoussein@gmail.com

Received: February 20, 2026
Revision Requested: March 18, 2026
Last Revision Received: May 26, 2026
Accepted: July 23, 2026
Publication Date: September 1, 2026

Cite this article as: Erdem M, Yıldırım S, Yılmaz SK, Doğan ŞE, Yüksel B. Handgrip strength as a multidimensional marker in adults living with obesity. *Endocrinol Res Pract.* 2026;30(4):254-260.

DOI: 10.5152/erp.2026.26934

Copyright @ Author(s) – Available online at http://endocrinolrespract.org
This journal is licensed under a Creative Commons (CC BY-NC-SA) 4.0 International License.

recent evidence has also demonstrated an association between low handgrip strength and diabetic foot disease in non-geriatric patients with type 2 diabetes, suggesting that muscle strength may reflect broader metabolic and vascular dysfunction.[20]

Therefore, the present study aimed to determine the prevalence of dynapenia in adults living with obesity and to examine its associations with body composition, metabolic markers, comorbidity burden, cognitive function, depressive symptoms, and physical activity.

Material and Methods

Study Design and Population

This cross-sectional study included 140 adults living with obesity who were followed at Sincan Training and Research Hospital, endocrinology outpatient clinic between January and October 2024. Eligible participants were aged 18-65 years with a body mass index (BMI) ≥ 30 kg/m^2.

Individuals were excluded if they had neuromuscular or musculoskeletal disorders, chronic kidney disease (estimated glomerular filtration rate <60 mL/min/1.73 m^2), chronic liver disease, active malignancy, endocrine disorders other than obesity or hypothyroidism, recent use of corticosteroids or anabolic agents, pregnancy, lactation, or cognitive or psychiatric conditions that could impair study participation.

Participants were consecutively recruited during routine outpatient visits, and all provided written informed consent prior to inclusion. Demographic and clinical data were obtained from electronic medical records.

The study protocol was approved by the Institutional Ethics Committee of Sincan Training and Research Hospital (Approval Number: BAEK-2025-26, Date: May 20, 2025) and conducted in accordance with the Declaration of Helsinki.

Anthropometric Assessment

Height and weight were measured using standardized procedures, with participants wearing light clothing and no shoes. Body mass index was calculated as weight in kilograms divided by height in meters squared (kg/m^2). Obesity classes were defined according to the World Health Organization (WHO) criteria (Class I: 30-34.9 kg/m^2; Class II: 35-39.9 kg/m^2; Class III: ≥40 kg/m^2).

Body composition parameters were assessed using a calibrated multifrequency bioelectrical impedance analysis (BIA) device (Tanita InnerScan, Tanita Corp., Tokyo, Japan). Measurements were performed according to the manufacturer's recommendations under standardized conditions by trained healthcare personnel. Participants were evaluated barefoot and in light clothing while standing upright on the analyzer platform. Measurements were obtained during routine outpatient visits under resting conditions to reduce the influence of recent food intake, hydration changes, and physical activity on impedance measurements. Patients with implanted electronic devices (e.g., pacemakers) were excluded from BIA assessment for safety reasons.

Muscle Strength and Physical Activity

Handgrip strength was measured using an electronic hand dynamometer (Camry EH101, Camry, Guangdong, China). Measurements were performed with participants seated, elbows flexed to approximately 90° and forearms in a neutral position. Participants were instructed to exert maximal grip force, and the highest value obtained from repeated measurements was used for analysis.

Handgrip strength was categorized as weak (dynapenic), normal, or strong according to age- and sex-specific reference values derived from manufacturer-provided normative data, yielding 3 groups (Table 1).

Physical activity was evaluated using the validated Turkish version of the International Physical Activity Questionnaire-Short Form (IPAQ-SF). Total physical activity was expressed in metabolic equivalent (MET)-min per week and categorized as low (<600), moderate (600-3000), or high (>3000), in accordance with established guidelines.

Laboratory Measurements

Venous blood samples were obtained between 08:00 and 09:00 following an overnight fast. Glucose, creatinine, lipid profile, liver enzymes, thyroid function tests, electrolytes, and hemoglobin were analyzed using standardized automated assays. Patients with known hypothyroidism receiving stable replacement therapy were not excluded if euthyroid during routine follow-up.

Psychometric and Cognitive Assessments

Cognitive function was screened using the AD8 Dementia Screening Interview, a validated tool for detecting cognitive impairment, with scores ≥2 indicating possible impairment. Depressive symptoms were assessed using the Beck Depression Inventory (BDI), a validated self-report instrument, with higher scores indicating greater symptom severity.

Comorbidities

Hypertension and hypothyroidism were identified based on clinical documentation in electronic medical records, including prior diagnoses and ongoing treatment. Comorbidity burden was quantified using the Charlson Comorbidity Index (CCI), a validated measure of multimorbidity.

Statistical Analysis

Statistical analyses were performed using Statistical Package for the Social Sciences version 25 (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for normality using the Shapiro–Wilk test

MAIN POINTS

- Dynapenia was present in 20.0% of adults with obesity, marking reduced muscle strength as a common phenotype in this population.
- Lower handgrip strength was associated with unfavorable body composition (higher body fat percentage, lower appendicular skeletal muscle mass index).
- Markers of muscle integrity, notably creatinine and hemoglobin, were significantly lower in individuals with dynapenia.
- Dynapenia was linked to greater depressive symptom burden and higher comorbidity load, reflecting broader metabolic and psychosocial vulnerability.
- Handgrip strength is a rapid, accessible, multidimensional marker that may support early risk stratification and functional assessment in adults with obesity.

Table 1. Age- and Sex-Specific Reference Ranges for Handgrip Strength (kg)

Age (years)	Male (kg)—Weak	Male (kg)—Normal	Male (kg)—Strong	Female (kg)—Weak	Female (kg)—Normal	Female (kg)—Strong
10-11	<12.6	12.6-22.4	>22.4	<11.8	11.8-21.6	>21.6
12-13	<19.4	19.4-31.2	>31.2	<14.6	14.6-24.4	>24.4
14-15	<28.5	28.5-43.3	>43.3	<15.5	15.5-27.3	>27.3
16-17	<32.8	32.8-49.2	>49.2	<17.2	17.2-29.3	>29.3
18-19	<36.3	36.3-55.5	>55.5	<19.2	19.2-30.8	>30.8
20-24	<36.0	36.0-56.0	>56.0	<19.5	19.5-31.0	>31.0
25-29	<37.7	37.7-57.5	>57.5	<20.6	20.6-31.4	>31.4
30-34	<36.0	36.0-55.5	>55.5	<21.5	21.5-34.3	>34.3
35-39	<36.0	36.0-55.5	>55.5	<21.8	21.8-34.5	>34.5
40-44	<36.0	36.0-55.5	>55.5	<18.9	18.9-32.7	>32.7
45-49	<33.8	33.8-55.5	>55.5	<18.6	18.6-34.0	>34.0
50-54	<39.7	39.7-55.1	>55.1	<18.1	18.1-31.9	>31.9
55-59	<33.8	33.8-54.4	>54.4	<17.7	17.7-31.1	>31.1
60-64	<28.3	28.3-48.0	>48.0	<17.2	17.2-30.5	>30.5
65-69	<27.2	27.2-44.0	>44.0	<16.8	16.8-29.2	>29.2
70-99	<21.3	21.3-35.1	>35.1	<14.7	14.7-24.5	>24.5

Reference data derived from the device's manufacturer norms.
kg, kilograms.
Dodds RM, Syddall HE, Cooper R, et al. Grip strength across the life course: normative data from 12 British studies. *PLoS One*. 2014;9:e113637. doi:10.1371/journal.pone.0113637.

and visual inspection of histograms and Q–Q plots. Variables with non-normal distribution were reported as median (interquartile range [IQR]), while normally distributed variables were expressed as mean ± standard deviation.

Given that most variables were not normally distributed, non-parametric methods were primarily used. Group comparisons were primarily performed using the Kruskal–Wallis test for comparisons of non-normally distributed continuous variables, while 1-way ANOVA was used only for variables fulfilling normality assumptions.

When overall group differences were significant, post-hoc pairwise comparisons were performed using Dunn's test with Bonferroni correction. Trend analyses across ordered categorical groups were conducted using the Jonckheere–Terpstra test.

Correlations were evaluated using Spearman's rank correlation coefficients. A 2-sided *P* value < .05 was considered statistically significant.

Results

A total of 140 adults living with obesity were included (84.3% women, n = 118; 15.7% men, n = 22). The median age was 49.0 years (interquartile range [IQR]: 39.0-56.0). The median BMI was 37.5 kg/m^2 (IQR: 37.0-41.5), with 31.4% classified as Class I obesity, 35.0% as Class II, and 33.6% as Class III according to WHO criteria. The median CCI score was 2.0. Hypothyroidism was present in 27.9%, hypertension in 65.0%, and type 2 diabetes mellitus in 64.3% of participants.

Regarding functional and psychological characteristics, 20.0% of participants were classified as dynapenic, 67.1% as having normal muscle strength, and 12.9% as strong. The median BDI score was 12.0 (IQR: 7.0-19.0), and the median AD8 score was 1.0 (IQR: 0-3.0). AD8 scores ≥ 2 were observed in 54.0% of participants, and mild-to-moderate depressive symptoms were present in 38.4%.

International Physical Activity Questionnaire-Short Form data were available for 137 participants. Of these, 58.4% (n = 80) had low physical activity, 32.1% (n = 44) moderate, and 9.5% (n = 13) high activity levels.

Group Differences by Muscle Strength

Significant differences in body composition and biochemical parameters were identified across dynapenia groups (Table 2). Post hoc pairwise comparisons with Bonferroni correction demonstrated significant differences between the dynapenic and strong groups in creatinine (adjusted *P* = .001) and hemoglobin (adjusted *P* = .001). Significant differences were also observed between the normal and strong groups for creatinine (adjusted *P* = .001), aspartate aminotransferase (adjusted *P* = .016), alanine aminotransferase (adjusted *P* = .004), and hemoglobin (adjusted *P* < .001). Beck Depression Inventory scores differed significantly between the dynapenic and strong groups (adjusted *P* = .004) and between the dynapenic and normal groups (adjusted *P* = .015).

Body fat percentage was 46.8% (IQR: 44.0-54.6) in the dynapenic group, 46.1% (IQR: 42.4-51.3) in the normal group, and 38.5% (IQR: 36.4-43.0) in the strong group (*P* = .001). ASMI was lowest in the dynapenic group (8.85 kg/m^2 [8.37-9.57]) compared with the normal group (8.98 kg/m^2 [8.34-9.86]) and the strong group (10.74 kg/m^2 [9.90-11.61]; *P* = .001).

Dynapenic individuals also exhibited lower serum creatinine levels (0.71 mg/dL [0.61-0.79] vs. 0.87 mg/dL [0.81-0.99] in strong individuals, *P* = .001) and lower hemoglobin levels (13.7 g/dL [12.75-14.75] vs. 15.45 g/dL [14.60-16.30], *P* < .001). Hypothyroidism was more prevalent in the dynapenic group (32.9%) than in strong individuals (5.6% *P* = .045). Dynapenic participants also had higher AD8 and BDI scores (*P* = .026 and *P* = .043, respectively).

Table 2. Baseline Characteristics of Participants According to Dynapenia Status

Variable		Dynapenic (n = 28)	Normal (n = 94)	Strong (n = 18)	*P*
Age (years)		49.5 (40.0-58.5)	50.0 (41.0-57.0)	40.5 (32.0-49.0)	.097
Female, n (%)		28 (100.0)	85 (90.4)	5 (27.8)	**<.001**
BMI (kg/m^2)		38.5 (34.3-42.0)	36.5 (33.5-41.8)	37.8 (36.9-40.0)	.578
Obesity degree, n (%)	Class I (30-34.9 kg/m^2)	7 (25.0)	33 (35.1)	5 (27.8)	.468
Obesity degree, n (%)	Class II (35-39.9 kg/m^2)	9 (32.1)	31 (32.4)	7 (38.9)	.468
Obesity degree, n (%)	Class III (≥40 kg/m^2)	12 (42.9)	30 (32.4)	6 (33.3)	.468
Body fat (%)		46.79 (44.00-54.55)	46.15 (42.40-51.35)	38.50 (36.40-43.00)	.001
Appendicular skeletal muscle mass index (kg/m^2)		8.85 (8.37-9.57)	8.98 (8.34- 9.86)	10.74 (9.90-11.61)	.001
Hypertension, n (%)		12 (42.9)	31 (33.0)	6 (33.0)	.622
Hypothyroidism, n (%)		9 (32.9)	29 (31.6)	1 (5.6)	.045
Type 2 diabetes mellitus, n (%)		13 (46.4)	49 (52.2)	8 (44.4)	.765
Creatinine (mg/dL)		0.71 (0.61-0.79)	0.76 (0.65-0.84)	0.87 (0.81-0.99)	.001
Albumin (g/dL)		4.30 (4.10-4.60)	4.30 (4.10-4.50)	4.30 (4.10-4.50)	.822
Aspartate aminotranspherase		17.50 (15.00-25.50)	19.00 (16.00-24.00)	24.50 (20.00-32.00)	.036
Alanine aminotranspherase		18.00 (13.00-31.00)	20.00 (15.00-27.00)	27.00 (22.00- 51.00)	.006
Total cholesterol		194.00 (172.00-230.00)	198.00 (170.00-220.00)	184.50 (152.00-230.00)	.727
Triglyceride		144.00 (108.00-211.50)	130.50 (95.00-198.50)	153.50 (11.50-284.00)	.224
Low density lipoprotein		118.00 (98.00-144.00)	116.50 (94.00-137.00)	106.00 (77.50-142.00)	.660
High density lipoprotein		49.00 (40.00-57.00)	52.00 (45.00-58.00)	44.50 (34.50-51.50)	.020
Hemoglobin A1C		6.50 (5.90-7.95)	6.25 (5.80-6.80)	6.40 (5.80-6.70)	.324
Hemoglobin (g/dL)		13.70 (12.75-14.75)	13.70 (12.6-14.5)	15.45 (14.60-16.30)	**<.001**
TSH (mIU/L)		1.86 (0.94-3.30)	1.97 (1.20-2.93)	2.02 (1.38-2.80)	.885
Free T4 (ng/dL)		1.28 (1.10-1.48)	1.20 (1.10-1.30)	1.30 (1.11-1.48)	.290
Free T3 (pg/mL)		2.95 (2.55-3.10)	2.75 (2.40-3.12)	2.97 (2.70-3.08)	.414
AD8 score		1.5 (0-3.0)	1.0 (0-3.0)	1.0 (0-3.0)	.026
Beck Depression Inventory Score		18.5 (11.0-22.0)	11.8 (5.0-18.0)	10.0 (5.0-13.0)	.043

Data are presented as median (IQR) or n (%). *P* values were calculated using the Kruskal–Wallis test for non-normally distributed continuous variables, one-way ANOVA for normally distributed variables, and the chi-square test for categorical variables. Post-hoc pairwise comparisons with Bonferroni-adjusted *P* values were performed following significant Kruskal–Wallis analyses. Trend analyses across ordered groups were conducted using the Jonckheere–Terpstra test.
A *P* value < .05 was considered statistically significant.

Trend analyses using the Jonckheere–Terpstra test demonstrated significant ordered trends across dynapenia categories for body fat percentage ($P = .001$), appendicular skeletal muscle mass index (ASMI; $P < .001$), creatinine ($P < .001$), hemoglobin ($P = .005$), AD8 score ($P = .041$), and BDI score ($P = .002$).

Associations with Physical Activity

Physical activity level was significantly associated with dynapenia ($\chi^2 = 10.75$, $P = .030$), with dynapenia being most prevalent in the low-activity group (15/80) and least common in the high-activity group (1/13).

Appendicular skeletal muscle mass index and handgrip strength did not differ significantly across physical activity categories ($P = .777$ and $P = .119$, respectively). Body fat percentage showed a decreasing trend across increasing activity levels (Jonckheere–Terpstra P for trend = .079).

Beck depression inventory and AD8 scores were similar across activity categories. Age differed significantly across physical activity groups, with the highest median age observed in the low-activity group (51 years) and the lowest in the high-activity group (43 years; $P = .010$). No significant differences were observed in other metabolic, hematologic, hepatic, or thyroid parameters (all $P > .050$).

Correlation Analysis

Handgrip strength correlated positively with ASMI ($\rho = 0.320$, $P < .001$), creatinine ($\rho = 0.245$, $P = .004$), and hemoglobin ($\rho = 0.249$, $P = .004$). Negative correlations were observed with body fat percentage ($\rho = -0.374$, $P < .001$), while a weak negative correlation with age

was observed but did not reach statistical significance (ρ = −0.139, *P* = .110).

No significant correlations were observed with BMI, lipid parameters, thyroid hormone levels, or inflammatory cell counts. No significant correlation was observed with AD8 scores, whereas BDI scores were negatively correlated with handgrip strength (ρ = −0.181, *P* = .036) (Figure 1).

Discussion

In this cross-sectional cohort of adults living with obesity, it was found that dynapenia is a prevalent and clinically meaningful condition associated with adverse body composition, impaired biochemical indicators of muscle integrity, and a greater depressive symptom burden. Collectively, these findings reinforce the concept that muscle strength—rather than muscle mass alone—represents a central determinant of overall health in individuals with obesity. The results align with a growing body of evidence indicating that handgrip strength serves as an accessible, inexpensive, and highly informative biomarker of metabolic, functional, and psychological vulnerability.[2-6]

Dynapenia and Body Composition: Beyond Muscle Mass

Adults living with obesity and dynapenia exhibited a distinct adverse phenotype characterized by higher body fat percentage, lower ASMI, and reduced levels of creatinine and hemoglobin. These findings are consistent with prior studies demonstrating that chronic inflammation, myosteatosis, and mitochondrial dysfunction impair muscle quality even in the presence of preserved muscle mass.[7-9]

The observed inverse relationship between handgrip strength and body fat percentage further supports the concept that excess adiposity adversely affects muscle performance independent of BMI. In contrast, the absence of an association between handgrip strength and BMI underscores the limitations of BMI as a surrogate marker of functional impairment in obesity. A weak negative association between age and handgrip strength was also observed; however, this did not reach statistical significance.

Biochemical Correlates: Metabolic and Hematologic Signatures

Reduced creatinine and hemoglobin levels observed in individuals with dynapenia may reflect impaired muscle metabolism and diminished oxygen-carrying capacity, both of which are critical for optimal muscle function. Large cohort studies have consistently shown that lower levels of hemoglobin and creatinine are associated with reduced muscle strength, impaired physical performance, and increased frailty.[21-23] Collectively, these findings suggest that dynapenia in adults living with obesity extends beyond a purely musculoskeletal condition and may represent a broader systemic phenotype characterized by metabolic and hematologic alterations.

Comorbidity Burden and Dynapenia

Comorbidity burden, as quantified by the CCI, has been implicated in functional decline and muscle weakness. Higher CCI scores are associated with multimorbidity-driven inflammation, reduced mobility, and accelerated neuromuscular deterioration.[21,22] Conditions that

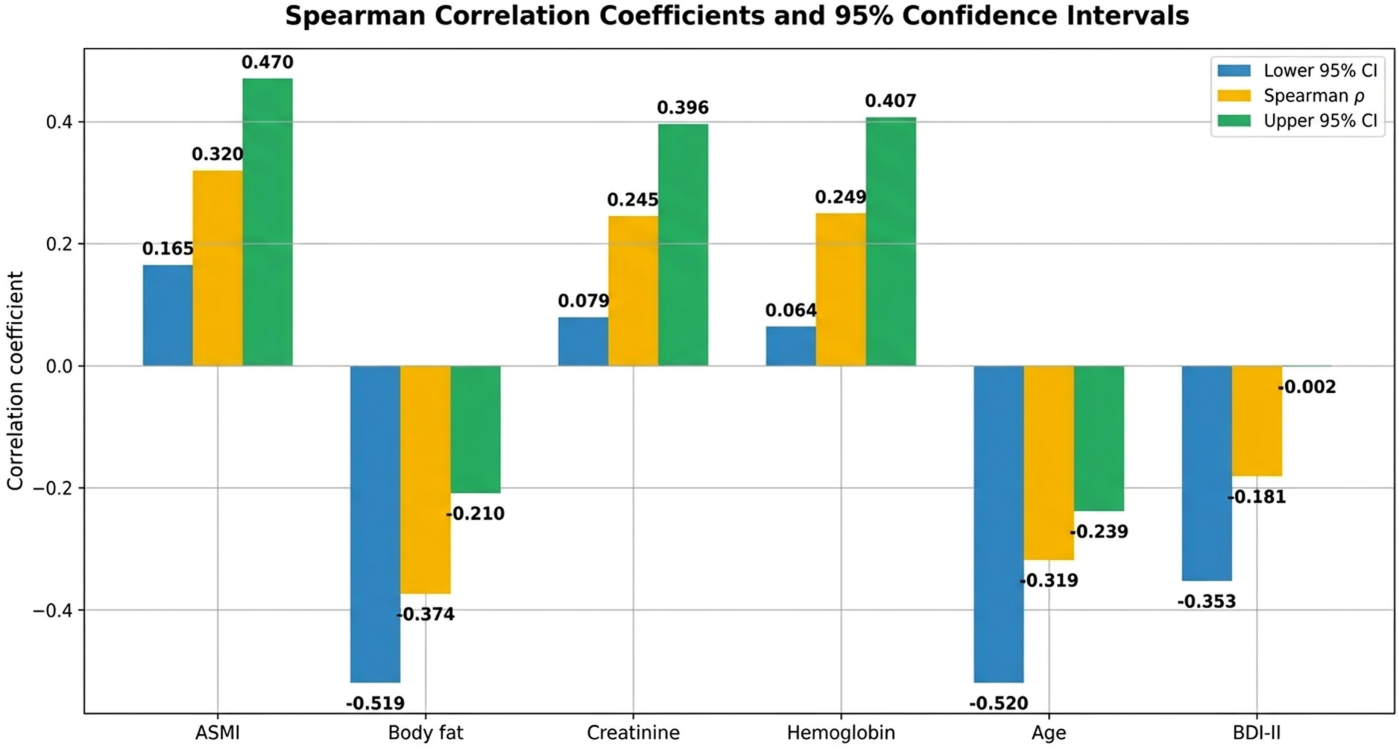

Figure 1. Spearman correlation coefficients (ρ) and corresponding 95% CIs between handgrip strength and selected clinical variables. Orange bars represent Spearman correlation coefficients, while blue and green bars indicate the lower and upper bounds of the 95% CIs, respectively. Handgrip strength showed positive correlations with appendicular skeletal muscle mass index, hemoglobin, and creatinine levels, and negative correlations with body fat percentage and Beck Depression Inventory-II) scores. The correlation with age was negative but did not reach statistical significance.

frequently coexist with obesity—such as diabetes, hypertension, thyroid dysfunction, and chronic inflammation—may act synergistically to impair muscle strength.

In this context, the findings suggest that reduced handgrip strength may serve as an early clinical indicator of multimorbidity-related vulnerability in adults living with obesity.

Cognitive and Psychological Correlates

Although AD8 scorAlthough AD8 scores were higher among individuals with dynapenia, the lack of a statistically significant correlation between handgrip strength and AD8 scores may be explained by the cohort's relatively younger age distribution and the screening-oriented nature of the AD8 instrument.igh proportion of AD8 scores ≥2 in the cohort may be influenced by lower educational levels and sociocultural factors, which can affect responses to screening-based cognitive assessments. Furthermore, the AD8 is a screening rather than diagnostic tool and may overestimate cognitive impairment in certain populations.

Nevertheless, prior studies have consistently shown that reduced grip strength is associated with cognitive decline, dementia, and impaired executive function,[10-12] potentially mediated through inflammatory, vascular, and physical activity-related pathways.

In contrast, depressive symptoms were significantly associated with lower muscle strength. Meta-analytic evidence indicates that dynapenia is strongly associated with depressive symptoms,[13-15] potentially mediated by chronic inflammation, hypothalamic–pituitary–adrenal axis dysregulation, physical inactivity, and reduced functional capacity. These findings further support the concept that handgrip strength may serve as an integrative marker of both physical and mental health, particularly in adults living with obesity, in whom psychological burden is frequently elevated.

Physical Activity and Dynapenia

Dynapenia was significantly more prevalent among individuals with low physical activity levels. These findings are consistent with population-based and longitudinal studies demonstrating that moderate-to-vigorous physical activity is associated with a reduced risk of dynapenia and sarcopenia.[17,18] Interventional studies further indicate that combined aerobic and resistance training improves muscle strength and reduces adiposity in adults with obesity and sarcopenic obesity.[19]

Notably, the absence of significant differences in ASMI across physical activity categories—despite observable gradients in muscle function—underscores the concept that muscle function, rather than muscle mass, more accurately reflects obesity-related neuromuscular impairment.

Handgrip Strength as a Clinical Tool

The most clinically relevant implications of these findings is the utility of handgrip strength as a rapid, noninvasive indicator of overall health. Large-scale studies have consistently shown that lower grip strength predicts disability, hospitalization, cardiovascular events, cognitive decline, and all-cause mortality.[2-6,10-12]

In the context of obesity care, where detailed body composition assessment can be technically demanding and resource-intensive, handgrip strength offers a simple, practical alternative for risk stratification. Incorporating grip strength assessment into routine clinical practice may facilitate the early identification of functional decline and support timely, targeted interventions, including resistance training, structured physical activity, nutritional optimization, and psychological evaluation.

Strengths and Limitations

Strengths of this study include standardized assessment protocols, comprehensive evaluation of anthropometric, biochemical, psychometric, and comorbidity measures, and the focus on a Mediterranean/Middle Eastern cohort—an understudied population in dynapenia research. The marked predominance of female participants and the absence of male individuals in the dynapenic group limit the generalizability of the findings and preclude robust sex-specific analyses. Due to the limited sample size and the relatively small number of dynapenia cases, multivariable regression analyses were not performed to minimize the risk of model overfitting. The cross-sectional design limits causal inference regarding the relationship between dynapenia and the observed clinical and metabolic parameters. Additionally, the use of a screening-based cognitive tool (AD8) may have led to overestimation of cognitive impairment, particularly in the context of lower educational levels and sociocultural factors that may influence responses. Given the number of comparisons performed, the possibility of type I error cannot be excluded; although Bonferroni correction was applied for post-hoc analyses, no global adjustment for multiple testing was implemented, as the study was exploratory in nature. Medication use and weight loss interventions were not included in the present analysis; however, this cohort is currently being followed longitudinally to evaluate the impact of anti-obesity therapies and weight reduction on muscle strength and dynapenia status.

Among adults living with obesity, dynapenia is prevalent and signals broader functional and mental health challenges. Simple handgrip assessment offers an accessible strategy to improve screening and guide targeted interventions.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Artificial Intelligence Usage Statement: The authors declared that no Artificial Intelligence Tool was used in the preparation of the manuscript.

Ethics Committee Approval: Ethical committee approval was received from the Sincan Training and Research Hospital Clinical Research Ethics Committee (Approval No.: BAEK-2025-26; Date: May 20, 2025).

Informed Consent: Written informed consent was obtained from the patients who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – M.E.; Design – M.E., S.Y.; Supervision – M.E.; Resources – M.E., S.Y., S.K.Y., Ş.E.D., B.Y.; Materials – M.E., S.Y., S.K.Y.; Data Collection and/or Processing – M.E., S.Y., S.K.Y., Ş.E.D., B.Y.; Analysis and/or Interpretation – M.E., S.Y.; Literature Search – M.E., S.Y.; Writing Manuscript – M.E., S.Y.; Critical Review – M.E., S.Y., S.K.Y., Ş.E.D., B.Y.

Declaration of Interests: The authors have no conflict of interest to declare.

Funding: The authors declare that this study received no financial support.

References

1. Clark BC, Manini TM. Sarcopenia ≠ dynapenia. *J Gerontol A Biol Sci Med Sci*. 2008;63(8):829-834. [CrossRef]

2. Leong DP, Teo KK, Rangarajan S, et al. Prognostic value of grip strength: findings from the Prospective Urban Rural Epidemiology (PURE) study. *Lancet*. 2015;386(9990):266-273. [CrossRef]
3. Celis-Morales CA, Welsh P, Lyall DM, et al. Grip strength as a biomarker of future health: findings from the UK Biobank. *BMJ*. 2018;361:k1651. [CrossRef]
4. Strandberg TE, Stenholm S, Strandberg AY, et al. The obesity paradox, frailty, disability, and mortality in older men: a prospective, longitudinal cohort study. *Age Ageing*. 2018;47:392-398.
5. Bohannon RW. Grip strength: an indispensable biomarker for older adults. *Clin Interv Aging*. 2019;14:1681-1691. [CrossRef]
6. McGrath R, Johnson N, Klawitter L, et al. Handgrip strength and adverse health outcomes: updated analytic strategies. *J Cachexia Sarcopenia Muscle*. 2022;13:2342-2355.
7. Prado CM, Heymsfield SB. Lean tissue imaging and implications for health and disease. *Nat Rev Endocrinol*. 2019;15:247-265.
8. Baracos VE, Arribas L. Body composition changes and metabolic consequences in obesity. *Lancet Diabetes Endocrinol*. 2020;8:616-628.
9. Batsis JA, Villareal DT. Sarcopenic obesity in older adults: a review of the definitions and clinical implications. *BMJ*. 2018;361:k2625.
10. Kishimoto H, Ohara T, Hata J, et al. Grip strength and incident dementia: a systematic review and meta-analysis. *Age Ageing*. 2022;51:afac114.
11. Firth J, Stubbs B, Vancampfort D, et al. Grip strength is associated with better cognitive performance in older adults: an umbrella review. *JAMA Psychiatry*. 2020;77:1-9.
12. Alfaro-Acha A, Al Snih S, Raji MA, et al. Handgrip strength and cognitive decline in older Mexican Americans. *J Am Geriatr Soc*. 2006;54:1256-1262.
13. Park JS, Kim JS, Lee SJ, et al. The association between handgrip strength and depression in adults: a systematic review and meta-analysis. *J Affect Disord*. 2020;277:406-416.
14. McDowell CP, Gordon BR, Herring MP. Associations of physical function and handgrip strength with mental health in adults. *Psychol Med*. 2021;51:1854-1863.
15. Hamer M, Batty GD, Kivimäki M. Grip strength and risk of psychological distress: findings from the UK Biobank. *J Epidemiol Community Health*. 2017;71:837-840.
16. World Health Organization. *Obesity and Overweight in the Eastern Mediterranean Region*. Cairo: WHO Regional Office for the Eastern Mediterranean; 2023.
17. Luo J, Lee RYW. Physical activity reduces the incidence of sarcopenia in middle-aged adults. *Ageing Int*. 2025;50(1):13. [CrossRef]
18. Zhuang M, Zhang H, Li Z, et al. Effects of three modes of physical activity on body composition, muscle mass, muscle strength, and IGF-1 in older people with sarcopenic obesity: a meta-analysis and systematic review. *Front Physiol*. 2022;13:917525.
19. Lai Z, Wang Y, Liu X, et al. Interactive effects of physical activity and sarcopenia on ischemic heart disease risk: a meta-analytic review. *Atherosclerosis*. 2024;379:117-125.
20. İmre E, İmre E. Unveiling the link between low handgrip strength and diabetic foot disease in non-geriatric type 2 diabetes patients. *Endocrinol Res Pract*. 2024;28(1):20-26. [CrossRef]
21. Cawthon PM, Blackwell TL, Marshall LM, et al. Chronic conditions and physical function in older men: the Osteoporotic Fractures in Men Study. *J Gerontol A Biol Sci Med Sci*. 2020;75:1330-1338.
22. Landi F, Calvani R, Picca A, et al. Impact of chronic diseases on dynapenia in community-dwelling older adults. *Age Ageing*. 2019;48:373-378.
23. Akune T, Muraki S, Oka H, et al. Association of chronic disease burden with muscle strength in adults: the ROAD Study. *Osteoporos Int*. 2013;24:795-801.