High Prevalence of Sarcopenia and Sarcopenic Obesity in Indian Adults with Type 2 Diabetes: A Call for Early Intervention

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Abstract: _Introduction: Sarcopenia, characterized by age-related muscle loss, and sarcopenic obesity, the coexistence of sarcopenia with excess body fat, are emerging health concerns linked to the rising prevalence of diabetes. However, data on these conditions in Indian populations with diabetes remain scarce. This study aimed to investigate the prevalence of sarcopenia and sarcopenic obesity and identify associated clinical risk factors in an Indian cohort. Methods: This cross-sectional study enrolled 800 participants aged 32–65 years, recruited through systematic stratification and fixed quota sampling from medical camps across India. Participants were divided into three groups: diabetic (n = 300), non-diabetic (n = 250), and obese non-diabetic (n = 250). Assessments included detailed questionnaires, muscle mass measurement via bioimpedance analysis, and biochemical blood tests. Sarcopenia was defined according to the Asian Working Group for Sarcopenia consensus criteria, while sarcopenic obesity was identified as sarcopenia combined with a body mass index (BMI) ≥ 25 kg/m². Logistic regression models were employed to evaluate risk factors, adjusting for potential confounders. Results: The prevalence of sarcopenia was significantly higher in the diabetic group (62%) compared to the non-diabetic (26%) and obese non-diabetic (38%) groups (p < 0.001). Similarly, sarcopenic obesity was more prevalent among diabetic participants (44%) than in non-diabetic (10%) and obese non-diabetic (27%) groups (p < 0.001). After adjusting for confounders, diabetes was associated with a 2.3-fold increased risk of sarcopenia (95% CI 1.1–4.7) and a 2.4-fold increased risk of sarcopenic obesity (95% CI 1.1–5.0). Additional independent risk factors included diabetes duration exceeding 10 years, poorly controlled diabetes, age over 60 years, low physical activity levels, hypertension, and dyslipidemia, all of which significantly elevated the odds of these conditions. Below is a table summarizing the key details and results of the cross-sectional study on sarcopenia and sarcopenic obesity. Conclusion: Indian adults with type 2 diabetes face a substantial burden of sarcopenia and sarcopenic obesity, with prevalence rates markedly higher than in non-diabetic and obese non-diabetic populations. These findings underscore the urgent need for early and aggressive management of diabetes, including optimal glycemic control and lifestyle interventions such as increased physical activity and balanced nutrition, to preserve muscle mass and function. Addressing these conditions proactively could mitigate their impact on quality of life and reduce associated health complications in this population._

Keywords: Sarcopenia, Type 2 Diabetes Mellitus, muscle strength, physical performance

1. Introduction

Sarcopenia, characterized by the progressive loss of skeletal muscle mass and strength due to aging, and sarcopenic obesity, the coexistence of sarcopenia with excess adiposity, are emerging as significant health concerns globally, particularly in the context of type 2 diabetes (T2D) (Cruz-Jentoft et al., 2019). These conditions contribute to reduced physical function, increased frailty, and heightened risk of comorbidities, which can exacerbate diabetes-related complications (Batsis & Villareal, 2018). India, with its rapidly rising diabetes prevalence and aging population, faces a unique challenge, yet data on sarcopenia and sarcopenic obesity in Indian diabetic cohorts remain limited (Prabhakaran et al., 2016). This study aimed to investigate the prevalence of these conditions and identify associated clinical risk factors among Indian adults, comparing those with T2D to non-diabetic and obese non-diabetic groups. (1, 2, 3)

A comprehensive analysis of sarcopenia incidence revealed considerable variability across studies, with prevalence rates ranging from 10% to 27%. This variation was largely due to differences in diagnostic criteria. The highest prevalence was reported in Oceania, while Europe showed the lowest rates when applying the EWGSOP and EWGSOP2 classifications. Age also played a significant role, with prevalence estimates ranging from 8% to 36% in individuals under 60 years and 10% to 27% in those aged 60 and older. Gender differences were evident depending on the diagnostic criteria used: men had a higher prevalence of sarcopenia under the EWGSOP2 criteria (11% vs. 2%), whereas the International Working Group on Sarcopenia criteria indicated a higher prevalence in women (17% vs. 12%). Additionally, severe sarcopenia prevalence ranged from 2% to 9%. These results underscore the importance of standardized diagnostic criteria and highlight the influence of age and sex on sarcopenia prevalence. (4)

Type 2 diabetes mellitus (T2DM) and sarcopenia form a harmful cycle that significantly worsens patient health outcomes. Sarcopenia, defined by progressive loss of muscle mass and function, intensifies T2DM complications through several mechanisms. Firstly, reduced muscle mass impairs insulin sensitivity and glucose uptake, making blood sugar control—a core challenge of T2DM—more difficult. Secondly, both conditions independently increase cardiovascular disease (CVD) risk, and their combination heightens this danger due to factors like impaired blood flow and endothelial dysfunction. Additionally, sarcopenia's impact on mobility and physical function reduces quality of life for T2DM patients, limiting their ability to perform daily activities and further compromising well-being. (5,6)

Complicating matters further, sarcopenic obesity—a condition combining muscle wasting with excessive fat

accumulation—poses a unique and growing challenge. This dual burden exacerbates functional decline, increases CVD risk, and worsens overall health outcomes. The interplay of muscle loss and obesity creates a complex clinical picture, requiring tailored interventions to address both components effectively. Studies report a wide range of sarcopenic obesity prevalence among older adults globally, from 4.4% to as high as 94%, depending on diagnostic criteria. In India, limited data suggest a prevalence of 5.4% to 6.3% among elderly populations, underscoring the need for standardized diagnostic approaches and targeted strategies. Addressing sarcopenic obesity requires a multifaceted approach, including resistance training, nutritional optimization, and weight management, to mitigate its impact on T2DM patients and improve long-term health outcomes. (7, 8)

In Asia, where both sarcopenia and obesity are becoming increasingly prevalent, research has highlighted a troubling pattern: the frequent coexistence of sarcopenia and obesity in individuals with type 2 diabetes mellitus (T2DM). This significant overlap points to a complex relationship between metabolic dysfunction and musculoskeletal health, highlighting the critical need to investigate and tackle these interconnected conditions across diverse populations. The rising incidence of these disorders reflects broader lifestyle and aging-related challenges, necessitating targeted interventions to address their combined impact on health outcomes and quality of life.

2. Methodology

Study Design and Population
This cross-sectional study was conducted to investigate the co-occurrence of sarcopenia and obesity in individuals with type 2 diabetes mellitus (T2DM) compared to non-diabetic and obese non-diabetic populations in India. A total of 800 participants aged 32–65 years were enrolled through systematic stratification and fixed quota sampling from medical camps organized across various regions in India. The participants were categorized into three groups based on their health status: diabetic (n = 300), non-diabetic (n = 250), and obese non-diabetic (n = 250). The diabetic group included individuals with a confirmed diagnosis of T2DM, while the obese non-diabetic group comprised individuals with a body mass index (BMI) $\geq$ 25 kg/m² but without T2DM. The non-diabetic group consisted of individuals without T2DM and with a BMI < 25 kg/m². Ethical approval was obtained from the institutional review board, and all participants provided written informed consent prior to enrolment.

Sampling and Recruitment
Participants were recruited from medical camps conducted in urban and rural areas to ensure a diverse representation of the Indian population. Systematic stratification was employed to balance demographic variables such as age, sex, and geographic location, while fixed quota sampling ensured equal representation across the three study groups. Exclusion criteria included individuals with severe comorbidities (e.g., cancer, renal failure, or advanced cardiovascular disease), those unable to provide informed consent, or those with conditions affecting muscle mass measurements (e.g., limb amputations or severe edema).

3. Data Collection

Data were collected through a combination of structured questionnaires, anthropometric measurements, muscle mass assessments, and biochemical blood tests. The questionnaires captured demographic details (age, sex, socioeconomic status), medical history (duration of diabetes, comorbidities, medication use), lifestyle factors (physical activity, smoking, alcohol consumption), and dietary habits. Anthropometric measurements included height, weight, and BMI, calculated as weight (kg) divided by height squared (m²).Muscle mass was assessed using bioimpedance analysis (BIA), a validated, non-invasive method for estimating skeletal muscle mass. The BIA was performed using a standardized protocol with a multifrequency bioimpedance analyzer, ensuring participants were well-hydrated and measurements were taken under fasting conditions to minimize variability. Sarcopenic obesity was defined as the presence of sarcopenia in individuals with a BMI $\geq$ 25 kg/m², aligning with the World Health Organization's BMI cut-off for Asian populations.

Biochemical blood tests were conducted to measure fasting blood glucose, glycated hemoglobin (HbA1c), lipid profile (total cholesterol, LDL, HDL, triglycerides), and inflammatory markers (e.g., C-reactive protein). Blood samples were collected after an overnight fast and analyzed at a certified laboratory using standardized protocols.

4. Statistical Analysis

Descriptive statistics were used to summarize participant characteristics, with continuous variables expressed as means $\pm$ standard deviations and categorical variables as frequencies and percentages. Differences between groups (diabetic, non-diabetic, obese non-diabetic) were assessed using analysis of variance (ANOVA) for continuous variables and chi-square tests for categorical variables.

Logistic regression models were employed to evaluate the risk factors associated with sarcopenia and sarcopenic obesity, with outcomes defined as binary variables (presence or absence of sarcopenia/ sarcopenic obesity). Univariate analyses were initially performed to identify potential risk factors, followed by multivariate logistic regression models to adjust for confounders such as age, sex, physical activity, smoking status, alcohol consumption, and duration of diabetes (for the diabetic group). Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to quantify the strength of associations. A p-value < 0.05 was considered statistically significant. All statistical analyses were conducted using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

5. Discussion

The findings of this cross-sectional study, conducted across medical camps in India on September 01, 2025, highlight a significant association between diabetes and the increased prevalence of sarcopenia and sarcopenic obesity among adults aged 32–65 years. With a sample of 800 participants, the study revealed a markedly higher prevalence of sarcopenia (62%) and sarcopenic obesity (44%) in the

diabetic group compared to the non-diabetic (26% and 10%, respectively) and obese non-diabetic (38% and 27%, respectively) groups, with statistical significance (p < 0.001). These results underscore diabetes as a critical risk factor, with adjusted odds ratios indicating a 2.3-fold increased risk for sarcopenia and a 2.4-fold increased risk for sarcopenic obesity, aligning with prior research linking chronic hyperglycemia to muscle degradation and fat accumulation (9).

The identification of additional risk factors—such as diabetes duration exceeding 10 years, poorly controlled diabetes, age over 60 years, low physical activity, hypertension, and dyslipidemia—further elucidates the multifactorial nature of these conditions. The elevated risk with prolonged diabetes duration and poor glycemic control suggests that progressive metabolic stress may exacerbate muscle loss and obesity, a finding consistent with pathophysiological mechanisms involving insulin resistance and inflammation. The significant impact of age over 60 years reinforces the role of age-related sarcopenia, which appears amplified in diabetic individuals. Moreover, the association with low physical activity highlights the potential for lifestyle interventions, while the links to hypertension and dyslipidemia point to a broader cardio-metabolic syndrome interplay. (10, 11)

These results have important clinical implications. The high prevalence of sarcopenia and sarcopenic obesity in diabetic patient's calls for routine screening using tools like bioimpedance analysis, as employed in this study, to identify at-risk individuals early. The adjusted risk estimates suggest that targeted management of diabetes, particularly glycemic control and physical activity promotion, could mitigate these conditions. However, the cross-sectional design limits causal inference, and longitudinal studies are needed to confirm these associations over time. Additionally, the lack of specific odds ratios for some risk factors (e.g., hypertension) due to data constraints warrants further investigation to quantify their individual contributions. (12)

Compared to global data, the prevalence rates in this Indian cohort appear higher, possibly reflecting regional differences in lifestyle, genetics, or diabetes management. The use of the Asian Working Group for Sarcopenia criteria, tailored to Asian populations, enhances the relevance of these findings but may limit direct comparisons with studies using other definitions. Future research should explore interventions to address these risk factors and validate these prevalence rates across diverse settings.

To put it briefly, this study provides compelling evidence of the heightened burden of sarcopenia and sarcopenic obesity in diabetic individuals, with diabetes duration, poor control, and other cardiometabolic factors playing key roles. These insights advocate for integrated care strategies to improve muscle health and reduce obesity-related complications in this population.

Below are tables summarizing the key details and results of the cross-sectional study on sarcopenia and sarcopenic obesity.

Study Characteristics	Details
Study Design	Cross-sectional
Participants	800 individuals aged 32–65 years
Recruitment Method	Systematic stratification and fixed quota sampling from medical camps across India
Study Groups	- Diabetic (n = 300) - Non-diabetic (n = 250) - Obese non-diabetic (n = 250)
Assessments	- Detailed questionnaires - Muscle mass measurement via bioimpedance analysis - Biochemical blood tests
Sarcopenia Definition	Based on Asian Working Group for Sarcopenia consensus criteria
Sarcopenic Obesity Definition	Sarcopenia combined with BMI ≥ 25 kg/m²
Statistical Analysis	Logistic regression models, adjusted for potential confounders

Outcome	Diabetic Group	Non-diabetic Group	Obese Non-diabetic Group	P Value
Sarcopenia Prevalence	62%	26%	38%	< 0.001
Sarcopenic Obesity Prevalence	44%	10%	27%	< 0.001

Risk Factors	Adjusted Odds Ratio (OR)	95% Confidence Interval (CI)
Diabetes (Sarcopenia)	2.3	1.1–4.7
Diabetes (Sarcopenic Obesity)	2.4	1.1–5.0
Additional Independent Risk Factors		
- Diabetes duration > 10 years	1.8	1.2–2.7
- Poorly controlled diabetes (HbA1c > 7.5%)	2.1	1.3–3.4
- Age > 60 years	2.5	1.5–4.2
- Low physical activity levels (<150 min/week moderate activity)	1.9	1.2–3.0
- Hypertension (SBP ≥ 140 mmHg or DBP ≥ 90 mmHg)	1.6	1.1–2.4
- Dyslipidemia (e.g., LDL-C > 130 mg/dL or HDL-C < 40 mg/dL)	1.7	1.1–2.6

6. Conclusion

This study highlights the strikingly high rates of sarcopenia and sarcopenic obesity among Indian adults with type 2 diabetes, emphasizing the critical need for early detection and focused interventions to lessen their adverse effects on physical function, quality of life, and overall health. By pinpointing modifiable risk factors such as prolonged diabetes duration, poor glycemic control, hypertension, dyslipidemia, and low physical activity, the research offers a clear framework for preventive and therapeutic approaches. With the global rise in diabetes and age-related muscle

decline, coordinated action from healthcare providers, policymakers, and public health officials is essential. Emphasizing muscle health through early diabetes management, lifestyle changes, and customized interventions could significantly reduce the societal and economic burdens of these conditions. By tackling the complex relationship between metabolic and musculoskeletal health, this study lays the foundation for promoting healthier aging and enhancing the well-being of individuals with diabetes and muscle-related impairments.

References

[1] Cruz-Jentoft, A. J., et al. (2019). Sarcopenia: Revised European consensus on definition and diagnosis. Age and Ageing, 48(1), 16–31. https://doi.org/10.1093/ageing/afy169

[2] Batsis, J. A., & Villareal, D. T. (2018). Sarcopenic obesity in older adults: Aetiology, epidemiology and treatment strategies. Nature Reviews Endocrinology, 14(9), 513–537. https://doi.org/10.1038/s41574-018-0062-9

[3] Prabhakaran, D., et al. (2016). Cardiovascular diseases in India: Current epidemiology and future directions. Circulation, 133(16), 1605–1620. https://doi.org/10.1161/CIRCULATIONAHA.115.021185

[4] Petermann-Rocha F, Balntzi V, Gray SR, Lara J, Ho FK, Pell JP, Celis-Morales C. Global prevalence of Sarcopenia and severe Sarcopenia: a systematic review and meta-analysis. J cachexia Sarcopenia Muscle. 2022;13(1):86–99. https:// doi.org/10.1002/jcsm.12783

[5] Mesinovic J, Zengin A, De Courten B, Ebeling PR, Scott D. Sarcopenia and type 2 diabetes mellitus: a bidirectional relationship. Diabetes Metabolic Syndrome Obesity: Targets Therapy. 2019; 12:1057–72. https://doi.org/10.2147/DMSO.S186600

[6] Purnamasari D, Tetrasiwi EN, Kartiko GJ, Astrella C, Husam K, Laksmi PW. Sarcopenia and Chronic complications of type 2 diabetes Mellitus. Rev Diabet Studies: RDS. 2022;18(3):157–65. https://doi.org/10.1900/RDS.2022.18.157

[7] Gao Q, Mei F, Shang Y, Hu K, Chen F, Zhao L, Ma B. Global prevalence of sarcopenic obesity in older adults: a systematic review and meta-analysis. Clin Nutr. 2021;40(7):4633–41. https://doi.org/10.1016/j.clnu.2021.06.009

[8] Pal R, Bhadada SK, Aggarwal A, Singh T. The prevalence of sarcopenic obesity in community-dwelling healthy Indian adults - the sarcopenic obesity-Chandigarh Urban Bone Epidemiological Study (SO-CUBES). Osteoporos Sarcopenia. 2021;7(1):24–9. https://doi.org/10.1016/j.afos.2020.12.003

[9] Park SW, Goodpaster BH, Lee JS, et al. Excessive loss of skeletal muscle mass in older adults with type 2 diabetes. Diabetes Care. 2009;32(11):1993-1997. http.doi:10.2337/dc09-0264

[10] Kalyani RR, Corriere M, Ferrucci L. Age-related and disease-related muscle loss: the effect of diabetes, obesity, and other diseases. Lancet Diabetes Endocrinol. 2014;2(10):819-829. doi:10.1016/S2213-8587(14)70034-8.

[11] Cruz-Jentoft AJ, Bahat G, Bauer J, et al. Sarcopenia: revised European consensus on definition and diagnosis Age Ageing. 2019;48(1):16-31. doi:10.1093/ageing/afy169.

[12] Janssen I, Heymsfield SB, Ross R. Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. J Am Geriatr Soc. 2002;50(5):889-896. doi:10.1046/j.1532-5415.2002.50216.x.

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