

## Reassessing Calf Circumference as a Marker of Muscle Mass in Sarcopenia and Malnutrition: Influence of Albumin Levels

[Helio Coelho-Junior](#)<sup>\*1</sup>, [Isabel Rodriguez Sanchez](#)<sup>2</sup>, [Alejandro Alvarez-Bustos](#)<sup>3</sup>, [Leocadio Rodriguez Mañas](#)<sup>4</sup>, [Emanuele Marzetti](#)<sup>5</sup>

<sup>1</sup> Department of Geriatrics, Orthopedics and Rheumatology, Università Cattolica del Sacro Cuore, L.go F. Vito 1, 00168 Rome, Italy

<sup>2</sup> Geriatrics Department, Hospital Universitario Clínico San Carlos, 28905 Madrid, Spain

<sup>3</sup> Biomedical Research Center Network for Frailty and Healthy Ageing (CIBERFES), Institute of Health Carlos III, 28029 Madrid, Spain

<sup>4</sup> Geriatrics Department, Getafe University Hospital, 28905 Getafe, Spain

<sup>5</sup> Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy

**Academic Editor:** Omar Cauli

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**Published:** 03 September 2025 by MDPI in [The 1st International Online Conference on Diseases](#) session [Geriatrics](#)

### Abstract:

**Introduction:** Sarcopenia and malnutrition are common among older adults, both characterized by the presence of low muscle mass. Early detection is essential to prevent adverse outcomes. Although international guidelines support the use of calf circumference (CC) as an alternative to gold-standard methods (e.g., dual-energy X-ray absorptiometry [DEXA]), supporting evidence remains limited. Moreover, CC values may be affected by clinical factors such as hypoalbuminemia, which alters oncotic pressure and may cause edema, potentially leading to false-negative results. This study examined the agreement between CC and DEXA in diagnosing sarcopenia and malnutrition, and assessed the moderating effect of albumin on CC.

**Methods:** Data from 1,048 older adult (>65) participants in Wave 2 of the National Health and Nutrition Examination Survey (NHANES) were analyzed. Appendicular skeletal muscle mass (ASM) was estimated using both CC and DEXA. Sarcopenia was defined by low muscle mass and reduced walking speed. Malnutrition was identified using GLIM criteria. Urinary albumin was measured via fluorescent immunoassay. Pearson's correlation, Kappa analysis, and adjusted linear regression were used.

**Results:** CC ( $r = 0.592$ ) and the ASM derived from CC ( $r = 0.592$ ) showed a moderate correlation with DEXA-based ASM. This correlation weakened ( $r = 0.355$ ) when values were adjusted for height<sup>2</sup> (skeletal muscle index). Regression analysis showed that each one-unit decrease in urinary albumin was associated with a 0.437 cm increase in CC. Kappa analysis showed moderate agreement for malnutrition ( $\kappa = 0.635$ ) and poor agreement for sarcopenia ( $\kappa = 0.372$ ) when comparing CC-based and DEXA-based assessments.

**Conclusion:** CC may not be a valid proxy for muscle mass in older adults, especially in the presence of hypoalbuminemia. Assessments based on CC and DEXA may classify different individuals as sarcopenic or malnourished.

**Keywords:** Physical Assessment; Fat free mass; Muscle atrophy; Frailty; Malnourishment