

# New Prediction Equations to Estimate Appendicular Skeletal Muscle Mass Using Calf Circumference on NHANES Data: Methodological Issues

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Dear Editor,

We read with great interest the study by Santos and colleagues published in the May 2019 issue of the *Journal of Parenteral and Enteral Nutrition*.<sup>1</sup> One of the authors' purposes was to develop new low appendicular skeletal muscle mass (ASM) prediction equations based on easily available demographic and anthropometric data.<sup>1</sup> For this purpose, they used data from the 1999 to the 2006 National Health and Nutrition Examination Survey (NHANES) editions.<sup>1</sup> Four prediction models were proposed from the available dataset and subsequently evaluated through multivariable linear regression analysis: (1) calf circumference, sex, ethnicity, and age as independent variables; (2) variables included in Equation 1 + arm and thigh circumferences; (3) variables included in Equation 2 + body mass index; and (4) variables included in Equation 3 + waist circumference.<sup>1</sup>

We would like to explain some methodological issues with this study. First, data in the NHANES are a population-based dynamic cohort, and the results are generalizable to the population rather than a person. Therefore, one of the main purposes of the prediction studies, which is to predict an outcome in a person, cannot be reached by applying the NHANES dataset. Second, to develop a prediction model, the interactions between important variables should be evaluated, and when qualitative interactions are present, final results can be impacted dramatically.<sup>2</sup> To develop and validate a prediction model, it is strongly recommended to use 2 different cohorts, or at least 1 cohort divided into groups that consist of patients with both a failure and a success outcome, and if the model is not validated, the main outcome of research is generally misleading results.<sup>2–6</sup> Different methods are usually applied for validation of a prediction model such as the split file, Jackknife, and bootstrap by multiple sampling or other well-known validation methods. Another unpleasant issue is missing data that can influence the model development. Missing data often follow a nonrandom pattern in which there is explanation and cause behind it, and if you remove all the missing values, you will lose the cause and explanation that affect your conclusion and the model development.<sup>3</sup>

The authors concluded that despite the good performance of the 4 developed equations in predicting ASM, the best results came from the equation constituted only by calf circumference, sex, race, and age. This equation allows satisfactory ASM estimation from a single anthropometric measurement.<sup>1</sup> Briefly, in prediction studies, the main purpose is to provide a model, index, or score applicable to an individual (patient). Finally, associations, even statistically significant ones, do not guarantee prediction.<sup>2,3</sup> In this letter, we discussed methodological issues in the study and suggest that any prediction study should consider the above-mentioned methodological issues.<sup>2–6</sup>

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