

# Novel Equations To Estimate Lean Body Mass in Maintenance Hemodialysis Patients

Nazanin Noori, MD, PhD<sup>1</sup>; Csaba P. Kovesdy, MD<sup>2</sup>; Rachelle Bross, PhD<sup>1</sup>; Antigone Oreopoulos, PhD<sup>3</sup>; Deborah Benner, MA, RD, CSR<sup>4</sup>; Rajnish Mehrotra, MD, FASN<sup>1</sup>; Joel D. Kopple, MD<sup>1</sup>; and Kamyar Kalantar-Zadeh, MD, MPH, PhD<sup>\*1</sup>

<sup>1</sup>Harold Simmons Center, Harbor-UCLA, Torrance, CA, United States; <sup>2</sup>Nephrology, Salem VA, Salem, VA, United States; <sup>3</sup>Univ. of Alberta, Edmonton, Alberta, Canada; and <sup>4</sup>DaVita, Denver, CO, United States.

## INTRODUCTION

- Reduced lean body mass (LBM) and muscle mass are of the main components of protein-energy wasting. Hence, accurate assessment of body composition including LBM is the key to reliable evaluation of the nutritional status in chronic kidney disease patients.
- Even though dual energy X-ray absorptiometry (DEXA) is considered a reference method for assessing body composition, very few dialysis clinics have direct access to DEXA machines.
- Therefore, developing and testing equations that can estimate LBM based on routinely available clinical and nutritional measures that correlate with LBM is of paramount clinical relevance
- In the present study, we examined the correlation of DEXA measured LBM with a number of nutritional markers including serum concentrations of creatinine (SCr), anthropometric measurements including mid-arm muscle circumference (MAMC) and handgrip strength (HGS), in 118 randomly selected hemodialysis patients. In a "development cohort" we developed equations to estimate LBM based on these measures and in a "validation cohort" in whom LBM was estimated using the portable near-infrared (NIR) technique we tested the validity of the created regression equations.

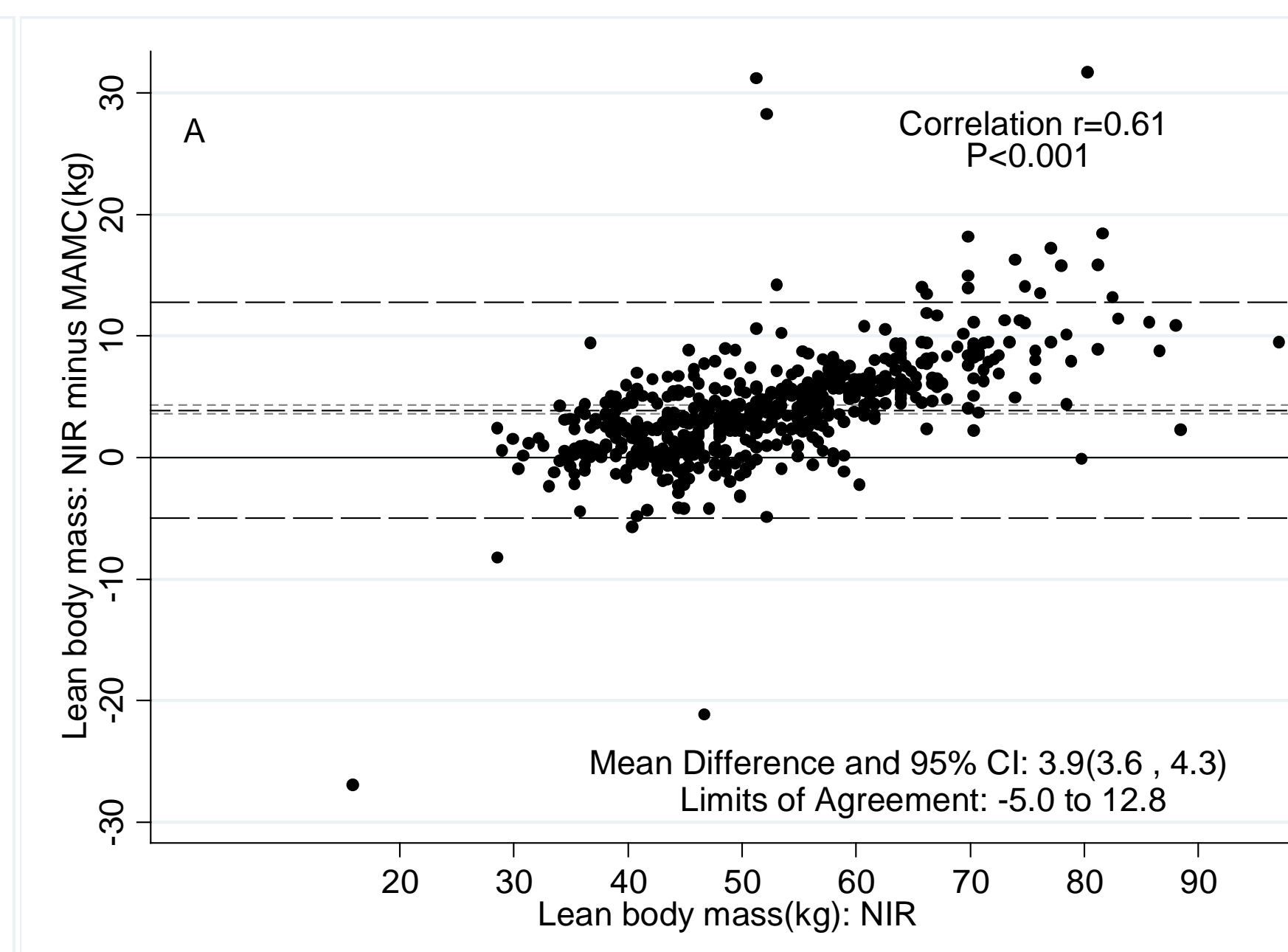
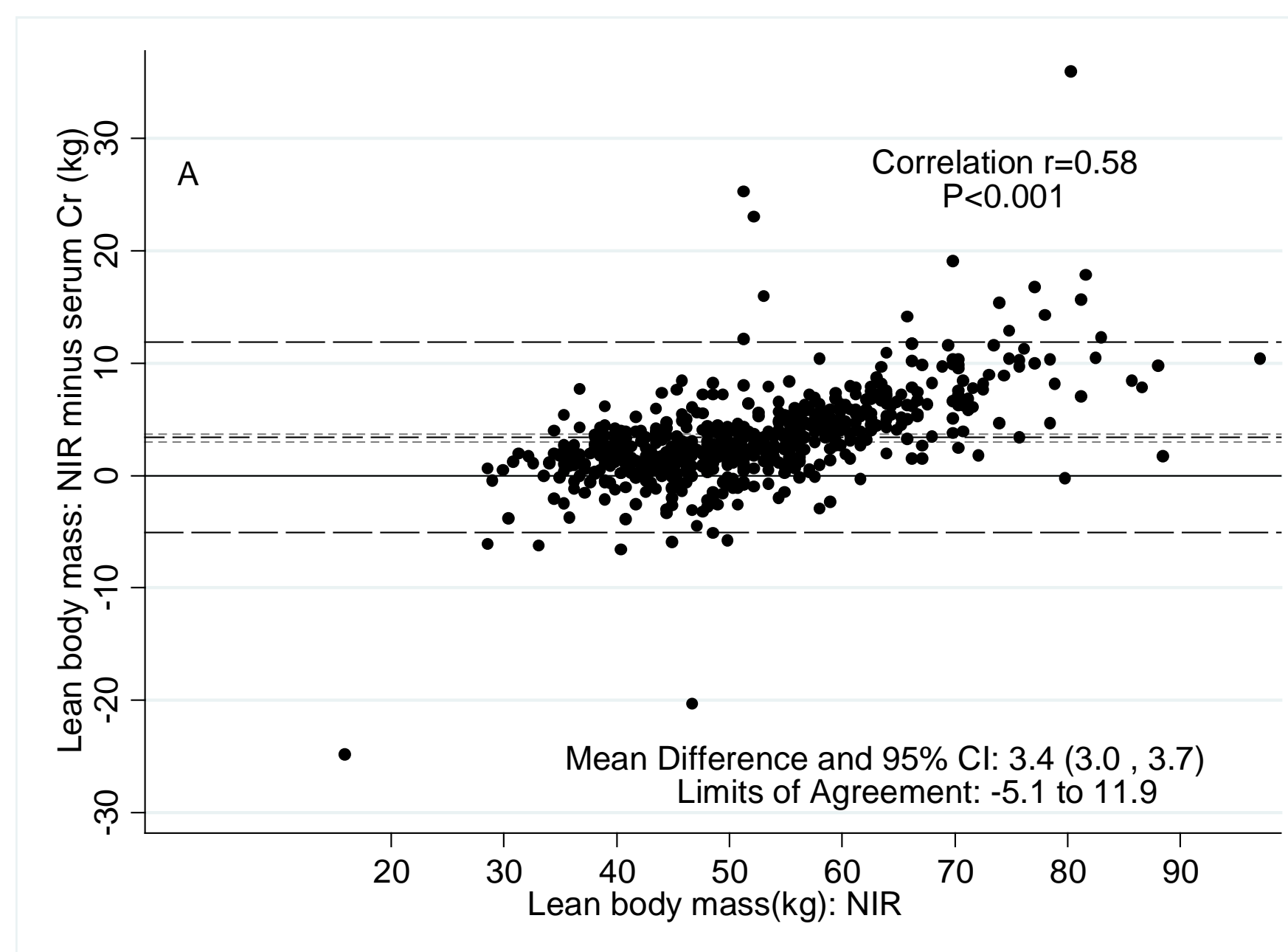
## METHODS & RESULTS

- The development cohort included 118 maintenance (MHD) patients, who underwent DEXA to assess their LBM. The validity of equations were tested against the NIR measured LBM in the validation cohort of 612 additional MHD patients.
- We used multiple linear regression analyses with least squares methods to develop the most parsimonious equations to predict LBM. Stepwise procedures led to the selection of 3 demographic variables (weight, height and gender), MAMC, SCr and HGS. Hence we created three equations using each of these three variables separately in combination with the selected demographic variables: gender (woman=1, man=0), height (inch) and weight.
- Both Difference Plots and Bland Altman analyses in the validation cohort showed compared to NIR, MAMC and SCr equations appeared accurate in predicting the LBM; however, they tended to underestimate LBM in participants with higher LBM (see figures).

$$\text{LBMSCr} = 0.34 * \text{SCr (mg/dL)} + 5.58 * \text{gender} + 0.30 * \text{weight (kg)} + 0.67 * \text{height (inch)} - 0.23 * \text{URR} - 5.75$$

$$\text{LBMHGS} = 9.09 * \text{HGS (unit)} + 5.15 * \text{gender} + 0.33 * \text{weight (kg)} + 0.74 * \text{height (inch)} - 29.06$$

$$\text{LBMMAMC} = 0.28 * \text{MAMC (cm)} + 5.52 * \text{gender} + 0.28 * \text{weight (kg)} + 0.82 * \text{height (inch)} - 35.30$$



## CONCLUSIONS

- In MHD patients, our novel equations to estimate LBM based on SCr, MAMC or HGS appear valid and yield accurate estimates of DEXA or NIR measured LBM, even though in higher LBM ranges they may underestimate it.

## KEY LEARNINGS

- ✓ SCr, MAMC and HGS are practical and inexpensive assessments that can be used for routine assessment of nutritional status or in clinical or epidemiologic studies, bearing their limitations in mind.
- ✓ Given emerging studies that indicate the association of greater muscle mass with better survival in hemodialysis patients, additional studies using these or other reference standards and equations are needed to verify the accuracy and reliability of our developed regression equations.

We thank the patients who participated in this study and DaVita Clinical Research® (DCR) for grant funding and support in preparing this poster. DCR is committed to advancing the knowledge and practice of kidney care.

\*Correspondence: Kamyar Kalantar-Zadeh, MD, PhD  
Email: kamkal@ucla.edu