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Response to "Lean body mass should not be used as a surrogate measurement of muscle mass in malnourished men and women: Comment on Compher et al"

To the Editor,

Professor Evans comments[1] on our recent Global Leadership Initiative on Malnutrition (GLIM) Guidance published in the *Journal of Parenteral and Enteral Nutrition*.[2] In the title of his letter, Dr Evans uses the term "lean body mass," an archaic body component description long abandoned by experts in the field. We believe this term is being used to refer to fat-free mass, the now accepted terminology for the component derived as the difference between body weight and fat mass. Dual-energy x-ray absorptiometry (DXA) systems quantify three components, fat, lean, and bone mineral content. Our review examined appendicular lean soft tissue as measured with DXA. This portion of body mass is largely fat-free skeletal muscle and is highly correlated with total body muscle mass as measured with magnetic resonance imaging.[3,4]

The focus of our review was on criterion methods for assessing muscle mass phenotypes in the context of malnutrition. Many practical, relatively low-cost methods are now widely available for quantifying regional and total body skeletal muscle mass[5] and function.[6] Moreover, approaches are increasingly available for evaluating the distribution of muscle fluid,[7] particularly when large accumulations of extracellular fluid are present.[8] Dehydration, a concern noted by Dr Evans, is uncommon in clinical settings and has only a small impact on relative tissue water content, as described in a classic 1968 paper by Moore and Boyden.[9]

Dr Evans describes the D_3-creatine dilution method for estimating the total body creatine pool size. The D_3 method refines approaches developed five decades ago by Meador et al.[10] Kreisberg et al.[11] and Picou et al.[12] Creatine is an intracellular compound distributed widely in multiple tissues,[13] the largest reservoir of which is skeletal muscle. As such, the total creatine pool size can be used as an indirect measure of muscle cell mass. This use of creatine pool size in this context is analogous to total body potassium, a classic marker of body cell mass.[14] The creatine pool size is not a "direct" measure of total body skeletal muscle mass, as stated by Dr Evans in his letter.[1] Total body muscle mass can be derived from the creatine pool size by making multiple assumptions, not unlike those made with other simpler and more available methods such as DXA or bioimpedance analysis. Perhaps one day, estimates of creatine pool size will fit into the clinical evaluation paradigm, but for now, the method is not adequately validated or practical for use in complex situations that involve acutely or chronically ill patients.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

Steven B. Heymsfield MD[1]
Carla M. Prado PhD[2]
M. Cristina Gonzalez MD[3]
Tommy Cederholm MD[4,5]
Gordon L. Jensen MD[6]
Rocco Barazzoni MD[7]
Charlene Compher PhD[8]

[1]*Pennington Biomedical Research Center, Louisiana State University, Baton Rouge, Louisiana, USA*
[2]*Department of Agricultural, Food & Nutritional Science, Human Nutrition Research Unit, University of Alberta, Edmonton, Alberta, Canada*
[3]*Postgraduate Program in Health and Behavior, Catholic University of Pelotas, Pelotas, Rio Grande do Sul, Brazil*
[4]*Department of Public Health and Caring Sciences, Clinical Nutrition and Metabolism, Uppsala University, Uppsala, Sweden*
[5]*Theme Aging, Karolinska University Hospital, Stockholm, Sweden*
[6]*Department of Medicine, Larner College of Medicine, University of Vermont, Burlington, Vermont, USA*
[7]*Department of Medical, Surgical and Health Sciences, University of Trieste, Trieste, Italy*
[8]*Department of Biobehavioral Health Science, University of Pennsylvania School of Nursing, Philadelphia, Pennsylvania, USA*

Correspondence
Steven B. Heymsfield, MD, Pennington Biomedical Research Center, Louisiana State University, Baton Rouge, LA, USA.
Email: steven.heymsfield@pbrc.edu

ORCID

Steven B. Heymsfield http://orcid.org/0000-0003-1127-9425
Carla M. Prado http://orcid.org/0000-0002-3609-5641

M. Cristina Gonzalez http://orcid.org/0000-0002-3901-8182
Gordon L. Jensen http://orcid.org/0000-0001-5223-7622
Charlene Compher http://orcid.org/0000-0001-8117-5387

REFERENCES

1. Evans WJ. Lean body mass should not be used as a surrogate measurement of muscle mass in malnourished men and women: comment on Compher et al. *J Parenter Enteral Nutr*. Published online April 19, 2022. doi:10.1002/jpen.2384
2. Compher C, Cederholm T, Correia MITD, et al. Guidance for assessment of the muscle mass phenotypic criterion for the Global Leadership Initiative on Malnutrition diagnosis of malnutrition. *J Parenter Enteral Nutr*. 2022;46:1232-1242.
3. Kim J, Wang Z, Heymsfield SB, Baumgartner RN, Gallagher D. Total-body skeletal muscle mass: estimation by a new dual-energy X-ray absorptiometry method. *Am J Clin Nutr*. 2002;76(2):378-383. doi:10.1093/ajcn/76.2.378
4. Heymsfield SB, Adamek M, Gonzalez MC, Jia G, Thomas DM. Assessing skeletal muscle mass: historical overview and state of the art. *J Cachexia Sarcopenia Muscle*. 2014;5(1):9-18. doi:10.1007/s13539-014-0130-5
5. Heymsfield SB, Smith B, Chung EA, et al. Phenotypic differences between people varying in muscularity. *J Cachexia Sarcopenia Muscle*. 2022;13(2):1100-1112. doi:10.1002/jcsm.12959
6. Bauer J, Morley JE, Schols AMWJ, et al. Sarcopenia: a time for action. An SCWD position paper. *J Cachexia Sarcopenia Muscle*. 2019;10(5):956-961. doi:10.1002/jcsm.12483
7. Kuchnia AJ, Yamada Y, Teigen L, Krueger D, Binkley N, Schoeller D. Combination of DXA and BIS body composition measurements is highly correlated with physical function-an approach to improve muscle mass assessment. *Arch Osteoporos*. 2018;13(1):97. doi:10.1007/s11657-018-0508-7
8. Belarmino G, Gonzalez MC, Sala P, et al. Diagnosing sarcopenia in male patients with cirrhosis by dual-energy X-ray absorptiometry estimates of appendicular skeletal muscle mass. *JPEN J Parenter Enteral Nutr*. 2018;42(1):24-36. doi:10.1177/0148607117701400
9. Moore FD, Boyden CM. Body cell mass and limits of hydration of the fat-free body: their relation to estimated skeletal weight. *Ann N Y Acad Sci*. 1963;110:62-71. doi:10.1111/j.1749-6632.1963.tb17072.x
10. Meador CK, Kreisberg RA, Friday JP, Jr., et al. Muscle mass determination by isotopic dilution of creatine-14C. *Metabolism*. 1968;17(12):1104-1108. doi:10.1016/0026-0495(68)90089-9
11. Kreisberg RA, Bowdoin B, Meador CK. Measurement of muscle mass in humans by isotopic dilution of creatine-14C. *J Appl Physiol*. 1970;28(3):264-267. doi:10.1152/jappl.1970.28.3.264
12. Picou D, Reeds PJ, Jackson A, Poulter N. The measurement of muscle mass in children using [15N]creatine. *Pediatr Res*. 1976;10(3):184-188. doi:10.1203/00006450-197603000-00008
13. Wyss M, Kaddurah-Daouk R. Creatine and creatinine metabolism. *Physiol Rev*. 2000;80(3):1107-1213. doi:10.1152/physrev.2000.80.3.1107
14. Wang Z, St-Onge MP, Lecumberri B, et al. Body cell mass: model development and validation at the cellular level of body composition. *Am J Physiol Endocrinol Metab*. 2004;286(1):E123-E128. doi:10.1152/ajpendo.00227.2003