

Response to: “The use of ultrasound for the estimation of muscle mass: one site fits most?”

We thank Takashi Abe, Jeremy P. Loenneke, and Robert S. Thibaud for their valuable response to our systematic review in their Letter entitled “The use of ultrasound for the estimation of muscle mass: one site fits most?”¹

We feel encouraged by their response that ultrasound has the potential to play an important role in assessing muscle mass in daily practice in the future. The authors remarked that we included only two studies in our systematic review that evaluated the validity of ultrasound-derived prediction equations for the prediction of muscle mass in older adults.² The authors elaborate on three other studies that indicate that forearm muscle thickness measurements could be used for the prediction of muscle mass in older adults. Although these articles provide additional information on the possibilities of muscle ultrasound for the prediction of muscle mass, we did not include these three articles in our systematic review because these articles were published later than the period included in our search,^{3,4} or did not meet our inclusion criterion for age.⁵

The authors' suggestion of using forearm muscle thickness measurements for the prediction of muscle mass is interesting for daily practice. It is very promising that the size of peripheral muscles is associated with (whole body) muscle mass. However, we do not fully agree with the statement that one site fits most. Despite the fact that the current definitions of sarcopenia and malnutrition focus on the assessment of (whole body) muscle mass,^{6,7} we would like to emphasize that the assessment of peripheral muscles is of utmost importance. It has previously been observed that the loss of muscle mass is not uniform across all muscles.⁸ In general, the loss of muscle mass of the lower limbs is a consequence of inactivity, whereas the loss of muscle mass in the upper limbs is more prone to nutritional depletion.⁹ This illustrates the importance of assessing peripheral muscles. Peripheral muscles can be quantified using muscle ultrasound, but muscle ultrasound can also be used to qualify the muscle, e.g. to assess the amount of intramuscular fat and scar tissue. These changes in muscle quality result in increased echogenicity, i.e. the reflectance of the emitted ultrasound signal,¹⁰ and are associated with decreased muscle function in older adults.¹¹ These findings implicate that not only the

size of the muscle matters but also the composition of muscles needs to be assessed.

In summary, we agree with Abe, Loenneke, and Thibaud that ultrasound has high potential for the assessment of muscles in daily practice. However, we believe that assessing peripheral muscles is equally, or may be even more, important than the prediction of muscle mass. Therefore, we propose a paradigm shift from the assessment of (whole body) muscle mass to quantifying and qualifying peripheral muscles.

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Willemke Nijholt

Research Group Healthy Ageing, Allied Health Care and Nursing, Hanze University of Applied Sciences, Groningen, The Netherlands
Department of Rehabilitation Medicine, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands
 w.nijholt@pl.hanze.nl

Harriët Jager-Wittenaar

Research Group Healthy Ageing, Allied Health Care and Nursing, Hanze University of Applied Sciences, Groningen, The Netherlands
Department of Maxillofacial Surgery, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands

Aldo Scafoglieri

Faculty of Medicine and Pharmacy, Vrije Universiteit Brussel, Brussels, Belgium

Johannes S.M. Hobbelen

Research Group Healthy Ageing, Allied Health Care and Nursing, Hanze University of Applied Sciences, Groningen, The Netherlands
Department of General Practice and Elderly Care Medicine, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands

Cees van der Schans

Research Group Healthy Ageing, Allied Health Care and Nursing, Hanze
University of Applied Sciences, Groningen, The Netherlands
Department of Rehabilitation Medicine, University of Groningen, University
Medical Center Groningen, Groningen, The Netherlands

Department of Health Psychology Research, University of Groningen
University Medical Center Groningen, Groningen, The Netherlands

References

1. Abe T, Loenneke JP, Thiebaud RS. The use of ultrasound for the estimation of muscle mass: one site fits most? *J Cachexia Sarcopenia Muscle* 2017; <https://doi.org/10.1002/jcsm.12257>.
2. Nijholt W, Scafoglieri A, Jager-Wittenaar H, Hobbelen JSM, van der Schans CP. The reliability and validity of ultrasound to quantify muscles in older adults: A systematic review. *J Cachexia Sarcopenia Muscle* 2017;**8**:702–712.
3. Abe T, Fujita E, Thiebaud RS, Loenneke JP, Akamine T. Ultrasound-derived forearm muscle thickness is a powerful predictor for estimating DXA-derived appendicular lean mass in Japanese older adults. *Ultrasound Med Biol* 2016;**42**:2341–2344.
4. Abe T, Loenneke JP, Thiebaud RS, Fujita E, Akamine T, Loftin M. Prediction and validation of DXA-derived appendicular fat-free adipose tissue by a single ultrasound image of the forearm in Japanese older adults. *J Ultrasound Med* 2017;**37**:347–353.
5. Abe T, Thiebaud RS, Loenneke JP, Young KC. Prediction and validation of DXA-derived appendicular lean soft tissue mass by ultrasound in older adults. *Age* 2015; **37**:114.
6. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, Boirie Y, Cederholm T, Landi F, et al. Sarcopenia: European consensus on definition and diagnosis: report of the European Working Group on Sarcopenia in Older People. *Age Ageing* 2010;**39**:412–423.
7. Cederholm T, Bosaeus I, Barazzoni R, Bauer J, van Gossum A, Klek S, et al. Diagnostic criteria for malnutrition—an ESPEN consensus statement. *Clin Nutr* **34**:335–340.
8. Janssen I, Heymsfield SB, Wang Z, Ross R. Skeletal muscle mass and distribution in 468 men and women aged 18–88 yr. *J Appl Physiol* 2000;**89**:81–88.
9. Heymsfield SB, Tighe A, Wang ZM. Nutritional assessment by anthropometric and biochemical methods. *Mod Nutr Health Dis* 1994;**8**:812.
10. Arts IM, Pillen S, Schelhaas HJ, Overeem S, Zwarts MJ. Normal values for quantitative muscle ultrasonography in adults. *Muscle Nerve* 2010;**41**:32–41.
11. Watanabe Y, Yamada Y, Fukumoto Y, Ishihara T, Yokoyama K, Yoshida T, et al. Echo intensity obtained from ultrasonography images reflecting muscle strength in elderly men. *Clin Interv Aging* 2013;**8**:993.
12. von Haehling S, Morley JE, Coats AJS, Anker SD. Ethical guidelines for authorship and publishing in the Journal of Cachexia, Sarcopenia and Muscle. *J Cachexia Sarcopenia Muscle* 2015;**6**:315–316.