JAMDA 16 (2015) 25–30

JAMDA

journal homepage: www.jamda.com

Original Study

An Anthropometric Prediction Equation for Appendicular Skeletal Muscle Mass in Combination With a Measure of Muscle Function to Screen for Sarcopenia in Primary and Aged Care

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Keywords:
Prediction equation
sarcopenia
older people
sensitivity and specificity

A B S T R A C T

Objectives: Sarcopenia is the presence of low muscle mass and poor physical function. We have developed an anthropometric prediction equation (PE). We compared the accuracy of our previously developed anthropometric prediction equation (PE) to dual absorptiometry x-ray (DXA) in predicting low muscle mass and sarcopenia.
Design: Cross-sectional study design.
Setting: Community dwelling.
Participants: Men and women aged 65 years and older.
Measurements: Gender-specific low muscle mass cutoffs were identified using the lowest 20% of the skeletal muscle index (SMI) where muscle mass was determined using PE in 611 men and 375 women aged 65 years and older. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of PE derived low muscle mass were compared with DXA-derived low muscle mass. The cohort was randomized into a development and validation group to identify various cutoffs for low muscle mass via the PE method and test its performance against the DXA method.
Results: The PE cutoff for low muscle mass was less than 8.05 kg/m^2 in men and less than 5.35 kg/m^2 in women. On validation of various cutoffs with improving sensitivity values from 70% to 97%, specificity increased from 45.5% to 85.7%, PPV increased from 31.3% to 56.9%, and NPV increased from 93.0% to 98.6% in men. In women, specificity improved from 42% to 72%, PPV reduced from 56.9% to 31.3%, and NPV improved from 93.0% to 98.6%. When the PE method was combined with a measure of muscle performance, a similar pattern of performance was observed.
Conclusion: The PE when combined with a measure of muscle function to create a screening tool performs as a "rule-out" test with high sensitivity values and NPVs.

Sarcopenia, or age-related muscle loss, is not just a serious condition in itself, but is associated with many adverse health consequences.[1] Studies have shown that deterioration in muscle mass quantity, as well as quality, is associated with an overall functional decline, reduced quality of life, falls, loss of independence, and mortality.[2–4] The direct health care cost arising from sarcopenia in

There are no specific conflicts of interests to declare relevant to this study. R.V. is a member of the Nestle Nutrition Australia Malnutrition in the Elderly Board and receives honorarium for this activity. R.V. has participated in the International Consensus Meeting on Protein Intake in the Elderly and the MNA International Initiative and both meetings were supported by educational grants from Nestle.

Aspects of this study were funded by the following research grants to Prof Renuka Visvanathan: (1) University of Adelaide, Faculty of Health Sciences, Establishment Grant; (2) Vincent Fairfax Family Foundation Research Fellowship through the Royal Australasian College of Physicians; and (3) Bernie Lewis Foundation Grant through the Queen Elizabeth Hospital Research Foundation; and a University of Adelaide, Faculty of Health Sciences, Divisional Scholarship to S.Y. to support his PhD studies.

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1525-8610/$ - see front matter © 2015 AMDA – The Society for Post-Acute and Long-Term Care Medicine
http://dx.doi.org/10.1016/j.jamda.2014.06.018

the United States was reported to be $18.5 billion in 2000. With the population ageing, these costs are now likely very much higher.[1]

Our group has recently confirmed that approximately 20% of men and women aged 80 years and older, living in the community in South Australia, have sarcopenia.[5] Early identification of sarcopenia will allow for early intervention, which in turn could prevent the downward spiral of decline in function and well-being seen with the development and worsening of the condition.[6]

The diagnosis of sarcopenia is made when low muscle mass is accompanied by low muscle function, which is either low muscle strength or low physical performance.[7] Measuring grip strength via a dynamometer or determining walk speed are measures of muscle performance. On the other hand, determining muscle mass is more complex and usually requires the use of dual-energy X-ray absorptiometry (DXA), which includes a trip to a health facility. If the individual with suspected sarcopenia is home bound, in a nursing home, or living in a rural area, it is unlikely that he or she will have easy access to DXA assessment.

We recently developed and validated an anthropometric prediction equation (PE) for appendicular skeletal muscle mass (ASM; discussed further in methods).[8] We propose that the ASM as derived from PE adjusted for height squared (ASM/height^2) when combined with a measure of muscle function could form a screening method for sarcopenia, applicable to primary and aged care settings.[8]

The aims of the current study, therefore, were primarily to evaluate the performance (sensitivity, specificity, positive predictive value [PPV], and negative predictive value [NPV]) of the newly developed anthropometric PE for ASM (ASM_{PE}) in detecting low muscle mass compared with the detection of low muscle mass by DXA (ASM_{DxA}). Also, further analysis was undertaken to identify the best cutoff to enable the PE to be applied as a "rule-out" screen.

Methods

The study had ethics approval from the Central Northern Adelaide Health Service Ethics of Human Research Committee. Informed consent was obtained from all participants.

Participants

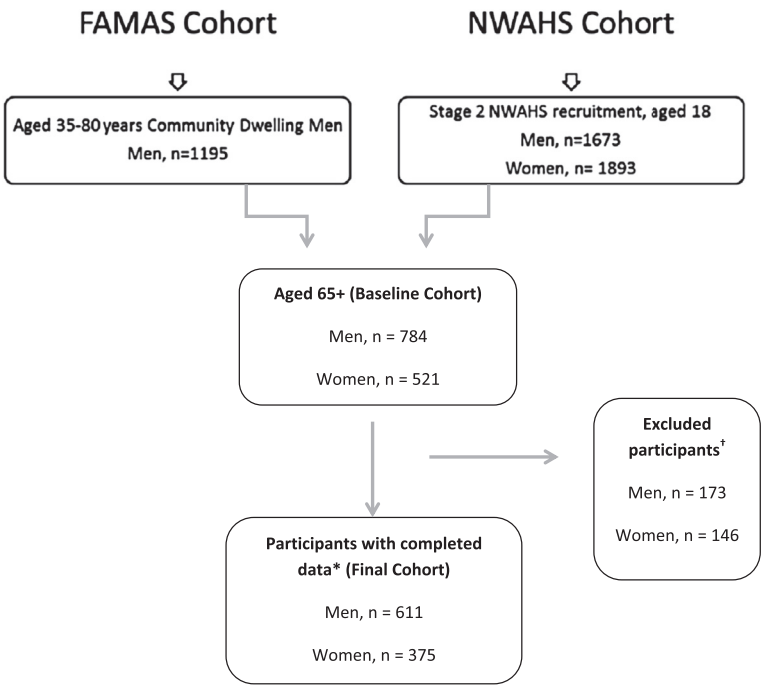
Two cohorts (Figure 1) of individuals aged 65 years and older were investigated in this study: The North West Adelaide Health Study (NWAHS), and the Florey Adelaide Male Ageing Study (FAMAS). The characteristics of these cohorts have been described in detail elsewhere and similar recruitment methods were used in both studies.[9,10]

NWAHS

Randomly selected adults aged 18 years and older from the northwest region of Adelaide were included in this longitudinal study[9]; 4060 adults were included in the baseline biomedical examination (stage 1) between December 1999 and July 2003. Follow-up occurred at a median of 4 years (stage 2) and 3566 individuals participated between May 2004 and February 2006. A total of 730 participants aged 65 years and older from stage 2 (men = 355, women = 375) who had all the required data were included in the final analysis.

FAMAS

The FAMAS is a longitudinal study of men only from the northwestern region of Adelaide. A total of 1195 community-dwelling men aged between 35 and 80 years were recruited between August 2002



* Completed data = those with completed measurements of DXA, grip strength, and anthropometric measurements (weight and height).

† Missing either one or more of the components of DXA, grip strength, and anthropometric measurements.

Fig. 1. Cohorts combined to develop the older study group (aged 65+).