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Thigh circumference measurement as a potential marker of leg skeletal muscle mass – cross sectional study in a U.S. population age 39–69 years

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As part of the normal ageing process, whole body skeletal muscle mass (SMM) declines, which can lead to changes in body composition, physical function and metabolic competence. Age related loss of muscle mass and function is known as sarcopenia[1]. SMM can be quantified in the laboratory using scanning techniques and can be predicted using selected bioimpedance systems. Given an increasingly ageing population and reduced health budgets, it could be argued that there is a need for a simple measurement that can be used both in the field and in clinical practice. However a simple low-cost and non-invasive technique is currently lacking. The thigh comprises the largest muscle group in the body and hence could act as a marker of leg and possibly whole-body SMM. Circumference measurements are used routinely in nutritional assessment although their role in predicting SMM in adult and ageing populations has not be fully evaluated. Thus the aim of this study was to investigate if leg SMM could be estimated from thigh circumference (TC) measurement using data from a representative sample of the middle-aged to older American population.

This study utilised data from the National Health and Nutrition Examination Survey (NHANES) between 2001 and 2002[2]. 241 adults aged between 39 and 69 years were selected for analysis. Demographic and body composition variables were extracted including height, weight, TC and DXA-derived measures of leg SMM (kg) and fat mass (FM) (kg). BMI was calculated and the relationships between TC and leg composition were assessed within BMI categories using correlation analysis.

In females, mean TC was 53·9 cm (range between 36·7 and 82·6 cm). Within each BMI category, significant but moderate correlations were found between the TC and leg SMM (kg) (normal weight, $r = 0{\cdot}523$, overweight $r = 0{\cdot}574$ and obese $r = 0{\cdot}680$, $p < 0{\cdot}002$). For FM (kg), stronger correlations were observed (normal weight, $r = 0{\cdot}684$, overweight $r = 0{\cdot}862$ and obese $r = 0{\cdot}886$, $p < 0{\cdot}001$). Within the male sample, mean TC was 54·6 cm (range between 43·3 and 69·7 cm). Moderate to strong and significant correlations were observed between TC and leg SMM (kg) in normal weight, overweight and obese groups ($r = 0{\cdot}769$, $r = 0{\cdot}611$ and $r = 0{\cdot}726$ respectively, $p < 0{\cdot}001$). For FM (kg), weaker correlations were observed in normal weight, $r = 0{\cdot}429$ and overweight, $r = 0{\cdot}348$ groups, $p < 0{\cdot}04$, whereas a stronger correlation was observed for the obese group, $r = 0{\cdot}755$, $p < 0{\cdot}001$).

These preliminary findings suggest that although TC is related to both leg SMM (kg) and FM (kg), TC may be a better marker of SMM (kg) in men than in women, and may be a better marker of SMM (kg) in normal and overweight men than in obese men. Using a greater sample size and correcting for leg FM (kg), it may be possible to develop a regression equation to predict SMM (kg) from TC. However, further work is required to establish whether TC could be used as a simple field-based or clinical technique to estimate leg SMM (kg) in adults and whether TC could also be valid in elderly individuals at risk of sarcopenia.

1. Roubenoff R (2000). *Eur J Clin Nutr* **54**, Suppl 3:S40–7.
2. National Health and Nutrition Examination Survey, 2013–2014 Overview. U.S Department of Health and Human Services, Center for Disease Control and Prevention.