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# Evaluation of novel measures of body composition and metabolic risk in US adults

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Cardiometabolic disease risk is related, in part, to body composition[1,2]. Body Mass Index (BMI), waist circumference (WC) and percentage body fat (%BF) are commonly used body measures but it remains unclear if they most accurately define the human phenotype with greatest metabolic impact. This study examined two novel measures – the appendicular skeletal muscle mass-to-total fat ratio (MFR) and the thigh circumference to waist circumference ratio (TWR) in relation to markers of cardiometabolic risk and compared them with the more conventional measures in a national US adult sample.

A total of 411 adults (218 males), aged between 16–69 y with body composition measured by DXA were extracted from the *National Health and Nutrition Examination Survey (NHANES) 2000–2002* database. This included a nationally representative sample of non-Hispanic white, non-Hispanic black, and Mexican American subjects. Blood pressure and blood lipids, glucose and insulin were outcome variables. MFR (appendicular skeletal muscle (kg)/total body fat (kg)) and TWR (thigh circumference (cm)/waist circumference (cm)) together with BMI, WC and %BF were examined to investigate statistical correlations with the cardiometabolic risk markers following adjustment for age.

Mean MFR was significantly higher in males compared with females (1.36 (0.55) *vs* 0.69 (0.25), $P<0.01$), whereas mean TWR was similar between genders (0.59 (0.07)). Significant negative relationships between MFR and TWR and age were observed ($r = -0.34$, $P = 0.003$, $r = 0.57$, $P = 0.001$ respectively). MFR was negatively related to total cholesterol ($r = -0.22$, $P = 0.004$), LDL ($r = -0.15$, $P = 0.05$), triglycerides ($r = -0.16$, $P = 0.034$) insulin ($r = -0.23$, $P = 0.001$) and glucose:insulin ratio ($r = -0.31$, $P = 0.0001$). %BF was related to total cholesterol ($r = 0.26$, $P = 0.0001$, LDL ($r = 0.19$, $P = 0.015$), insulin ($r = 0.29$, $P = 0.0001$) and glucose:insulin ratio ($r = 0.37$, $P = 0.0001$). When stratified by gender, BMI and WC in females correlated with total cholesterol ($r = 0.23$, $P = 0.038$, $r = 0.23$, $P = 0.039$ respectively) and LDL ($r = 0.28$, $P = 0.01$, $r = 0.26$, $P = 0.03$ respectively) while both MFR and TWR were significantly associated with HDL ($r = 0.24$, $P = 0.033$, $r = 0.25$, $P = 0.02$) and triglycerides ($r = -0.21$, $P = 0.05$, $r = -0.38$, $P = 0.001$). In males, BMI was associated with HDL ($r = -0.27$, $P = 0.011$) and insulin ($r = 0.45$, $P = 0.0001$). TWR was strongly related to glucose ($r = -0.21$, $P = 0.005$), insulin ($r = -0.4$, $P = 0.0001$) and glucose:insulin ratio ($r = 0.37$, $P = 0.0001$).

These findings show that these two novel phenotypic markers perform as well as the more commonly used measures when predicting cardiometabolic risk factors. Thus MFR and TWR could be added to the suit of body measures for assessing metabolic disease risk with evidence to suggest that they show potential as improved measures, although further investigation is required to verify this suggestion. In the absence of measures of skeletal muscle and body fat, TWR may offer as a simple, inexpensive alternative.

1. Baumgartner RN, Heymsfield SB & Roche AF (1995) *Obes Res* **3**, 73–95.
2. Kim CS, Nam YJ, Park JS *et al.* (2004) *Yonsei Med J* **45**, 469–478.