

## Letter to the Editor



# Total Body Less Head Measurement Is Most Appropriate for Lean Mass Assessment in Adults

To the Editor:

Exclusion of the head from total-body dual-energy X-ray absorptiometry (DXA) scans is recommended when measuring pediatric bone mass (1,2). We write to suggest that a similar approach, that is, total body less head (TBLH) measurement, should be considered when measuring total-body lean mass in adults.

DXA-measured total-body lean mass is often used as a surrogate for muscle mass in athletic performance settings and sometimes in clinical research studies. However, it is essential to appreciate that DXA lean mass is not simply a measurement of muscle; indeed, DXA fat-free mass is largely water (3). Consequently, up to ~10% of DXA-measured whole-body lean mass is located in the head, presumably primarily a measurement of water within the brain. As such, the head constitutes a region that contributes little to skeletal muscle function/physical performance and could not be expected to be altered by exercise regimens or pharmacological approaches designed to improve muscle mass and physical performance. To explore the potential importance of this phenomenon, we assessed the proportion of total-body lean mass contained within the head region on DXA total-body scans in adults across the life span.

Initially, we evaluated DXA total-body scans in 112 men and women aged  $\geq 70$  yr (mean age  $80.6 \pm 6.0$ ). In this group, the proportion of lean mass located in the head (mean [standard deviation]) was 7.3% (1.0), ranging from 4.7% to 9.2%. The percentage of lean mass in the head was negatively correlated with total-body lean mass using linear regression analysis (i.e., as lean mass declines, the proportion located in the head increases; Fig. 1;  $r^2 = 0.71$ ,  $p < 0.0001$ ). To further explore potential age relationships, the percent head lean mass was calculated in a younger cohort ( $n = 610$ ) composed of a convenience sample from a midlife US aging study, MIDUS (4), and a group of university athletes. This cohort was arbitrarily divided as young (ages 19 to  $< 40$  yr) and middle age ( $\geq 40$  to 65 yr). Mean head lean mass was 5.6% and 6.3% in the young and middle-aged groups, respectively. The percentage of lean mass within the head differed between these 3 age groups by analysis of variance ( $p < 0.0001$ ). Similar to the

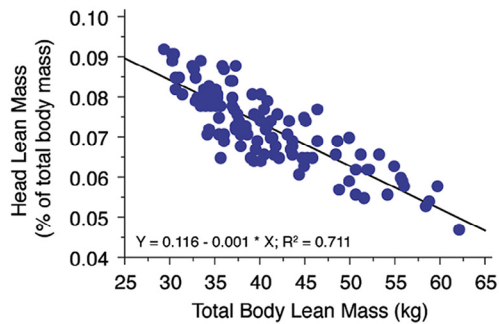
initial observation made in older adults, linear regression demonstrated a negative correlation of percent head lean mass with whole-body lean mass in the entire cohort ( $r^2 = 0.75$ ,  $p < 0.0001$ ). The 2 clinical studies were approved by the University of Wisconsin Health Sciences internal review board and student athlete data were classified as exempt.

We believe it is important that athletic trainers, clinicians, and researchers using DXA to monitor exercise interventions appreciate this phenomenon and consider the use of TBLH lean mass as such interventions will have little to no effect on head lean mass. A similar approach may be even more important in studies of older adults with sarcopenia. Indeed it is plausible that the higher percentage of lean mass located in the head region among older adults who have lower total lean mass potentially indicates that head lean mass (likely primarily water within the brain) is largely retained with advancing age, whereas lean mass elsewhere (presumably largely muscle) declines. Since the proportion of head lean mass is greatest in those with lowest muscle mass (the group targeted for therapeutic sarcopenia interventions), including a larger amount of “lean mass” that cannot be altered by muscle building therapies seems destined to impair the ability of such therapies to have a beneficial effect.

In conclusion, the head can account for up to 10% of whole-body lean mass in individuals' aged  $\geq 70$  yr. Exclusion of head lean mass is appropriate when total-body DXA is used as a surrogate for muscle mass in settings where interventions are being undertaken to enhance muscle mass. The option to select TBLH in total-body DXA scans should not be limited to the pediatric age range.

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**Fig. 1.** The proportion of lean mass contained in the head is negatively correlated with total-body lean mass ( $p < 0.0001$ ,  $r^2 = 0.711$ ), demonstrating the greatest head lean mass in those with the lowest whole-body lean mass.

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