

## LETTER TO THE EDITOR

# Application of a specific equation to calculate fat-free mass (FFM) in Australian aboriginals

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We read with interest the article of Hughes *et al.* on the development of a specific equation for calculating fat-free mass (FFM) in Australian aboriginal people and the validation of this equation against the gold standard methods for measuring FFM.

We have been using the Tanita (Tanita model TBF 521, Tanita Corporation, Tokyo, Japan; single frequency, leg to leg) bioelectric impedance assessment (BIA) scales for estimating FFM for the past 16 years in our longitudinal Aboriginal Birth Cohort study.<sup>1,2</sup> The main reasons for choosing these Tanita scales were; ease of use, the robustness in the field and transportability over vast distances that the researchers have to travel to see the study participants.

We have long been concerned about the limitations in accuracy of this method compared with the gold standards for measuring fat and FFM such as dual-energy X-ray absorptiometry (DXA) and computed tomography (CT) scans, not only in general but specifically in Australian aboriginal people. Despite some evidence demonstrating the reliability of this method when compared with DXA<sup>3</sup> concerns in using these scales remain. The concerns relate to the variation in this calculated FFM due to hydration status and differences in measurement using a leg-to-leg impedance as compared with either an arm-to-leg measurement or a multi-frequency BIA.<sup>4</sup> Owing to the multiple study sites, most of which are in remote locations, it has not been logistically feasible to provide CT scan or DXA in field conditions. Hence, we have been unable to use the various direct methods of fat measurement in

our study population and have been using the calculated FFM derived from the resistance measured by BIA scales.

We used the opportunity provided by the equation developed by Hughes *et al.*<sup>5</sup> to compare the specifically calculated FFM with the FFM calculated by the Tanita scales (which also uses gender, age, height and resistance). The read-out from the Tanita BIA scales provides the resistance as well as the calculated values, so it was possible to derive the FFM as per the equation developed by Hughes *et al.*

Data were available for 388 participants aged 16–20.1 years, of which 198 were males and 190 were females. We used the same statistical methods as Hughes *et al.*, mainly Brandt–Altman limits of agreement and Lin's coefficient of concordance in addition to Pearson's correlation coefficient. The Pearson's correlation coefficient of FFM\_Tanita compared with the FFM\_Hughes showed a correlation of 0.9733. Lin's concordance correlation coefficient for the same was 0.969. The average difference was 0.117, the s.d. was 2.666 and the Brandt–Altman's 95% confidence limits were –5.109 and 5.343.

Figure 1 shows the comparison of the FFM obtained from these two equations.

The strong correlation of the FFM obtained by these Tanita BIA scales to the calculated FFM by a validated equation specifically for Australian aboriginals, suggests that the Tanita BIA is not only easy and convenient but is also a reliable way to measure FFM in the field.

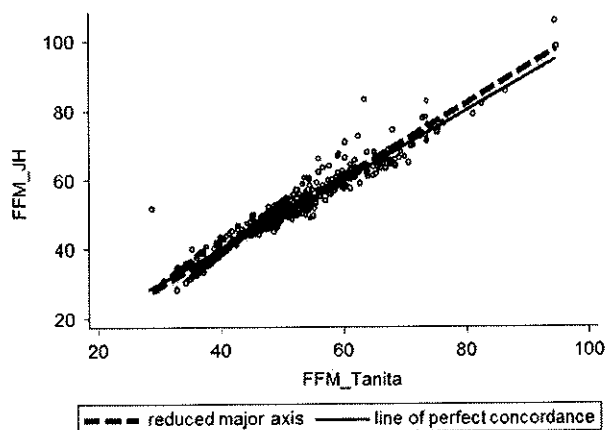
## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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**Figure 1.** Scatter plot of FFM\_Tanita and FFM\_JH, with line of best fit in the Aboriginal Birth Cohort participants. FFM\_JH: FFM calculated using the specific equation developed by Hughes *et al.* FFM\_Tanita: FFM calculated automatically by the Tanita scales (model TBF 521).

## REFERENCES

- 1 Sayers S, Singh G, Mackerras D, Lawrence M, Gunthorpe W, Jamieson L *et al.* Australian Aboriginal Birth Cohort study: follow-up processes at 20 years. *BMC Int Health Hum Rights* 2009; **9**: 23.
- 2 Sayers SM, Mackerras D, Singh G, Bucens I, Flynn K, Reid A. An Australian Aboriginal birth cohort: a unique resource for a life course study of an Indigenous population. A study protocol. *BMC Int Health Hum Rights* 2003; **3**: 1.
- 3 Beeson WL, Batech M, Schultz E, Salto L, Firek A, DeLeon M *et al.* Comparison of body composition by bioelectrical impedance analysis and dual-energy X-ray absorptiometry in Hispanic diabetics. *Int J Body Compos Res* 2010; **8**: 45–50.
- 4 Talma H, Chinapaw MJ, Bakker B, HiraSing RA, Terwee CB, Altenburg TM. Bioelectrical impedance analysis to estimate body composition in children and adolescents: a systematic review and evidence appraisal of validity, responsiveness, reliability and measurement error. *Obes Rev* 2013; **14**: 895–905.
- 5 Hughes JT, Maple-Brown LJ, Piers LS, Meerkin J, O'Dea K, Ward LC. Development of a single-frequency bioimpedance prediction equation for fat-free mass in an adult Indigenous Australian population. *Eur J Clin Nutr* 2015; **69**: 28–33.