Proceedings of the Nutrition Society (2024), **83 (OCE1)**, E90 doi:10.1017/S0029665124001083

47th Annual Scientific Meeting of the Nutrition Society of Australia and Nutrition Society of New Zealand, 28 November – 1 December 2023, Nutrition & Wellbeing in Oceania

Comparison of body composition assessment tools in infancy

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The prevalence of childhood obesity is increasing globally[1]. While BMI is commonly used to define obesity, it is unable to differentiate between fat and muscle mass, leading to calls to measure body composition specifically[2]. While several tools are available to assess body composition in infancy, it is unclear if they are directly comparable. Among a subset of healthy infants born to mothers participating in a randomised controlled trial of a preconception and antenatal nutritional supplement[3], measurements were made at ages 6 weeks (n = 58) and 6 months (n = 70) using air displacement plethysmography (ADP), whole-body dual-energy X-ray absorptiometry (DXA), and bioelectrical impedance spectroscopy (BIS). Estimates of percentage fat mass (%FM) were compared using Cohen's kappa statistic (κ) and Bland-Altman analysis [4,5]. There was none to weak agreement when comparing tertiles of %FM (κ = 0.15–0.59). When comparing absolute values, the bias (i.e., mean difference) was smallest when comparing BIS to ADP at 6 weeks (+1.7%). A similar bias was observed at 6 months when comparing DXA to ADP (+1.8%). However, when comparing BIA to DXA at both ages, biases were much larger (+7.6% and +4.7% at 6 weeks and 6 months, respectively). Furthermore, there was wide interindividual variance (limits of agreement [LOA] i.e., ± 1.96 SD) for each comparison. At 6 weeks, LOA ranged from ± 4.8 to ± 6.5% for BIA vs. DXA and BIA vs. ADP, respectively. At 6 months, LOA were even wider, ranging from ± 7.3 to ± 8.1% (DXA vs. ADP and BIA vs. DXA, respectively). Proportional biases were apparent when comparing BIS to the other tools at both ages, with BIS generally overestimating %FM more among infants with low adiposity. In addition to differences according to tool type, within-tool factors impacted body composition estimation. For ADP measurements, the choice of FFM density reference (Fomon vs. Butte) had minimal impact; however, choice of DXA software version (GE Lunar enCORE basic vs. enhanced) and BIS analysis approach (empirical equation vs. mixture theory prediction) led to very different estimates of body composition. In conclusion, when comparing body composition assessment tools in infancy, there was limited agreement between three commonly used tools. Therefore, researchers and clinicians must be cautious when conducting longitudinal analyses or when comparing findings across studies, as estimates are not comparable across tools.

Keywords: air displacement plethysmography, bioelectrical impedance, body composition, dual-energy X-ray absorptiometry

Ethics Declaration

Yes

Financial Support

KMG is supported by the National Institute for Health Research (NIHR Senior Investigator (NF-SI-0515-10042) and NIHR Southampton Biomedical Research Center (IS-BRC-1215-20004)), British Heart Foundation (RG/15/17/3174) and the European Union (Erasmus+ Programme ImpENSA 598488-EPP-1-2018-1-DE-EPPKA2-CBHE-JP). SYC is supported by a Singapore NMRC Clinician Scientist Award (NMRC/CSA-INV/0010/2016; MOH-CSAINV19nov-0002). WSC is supported by A Better Start National Science Challenge Research Programme. Funding for aspects of the NiPPeR study has been provided by Société Des Produits Nestlé S.A under a Research Agreement with the University of Southampton, Auckland UniServices Ltd, SICS, National University Hospital Singapore PTE Ltd, and NUS. Public good funding for the investigator-led NiPPeR study is through the UK Medical Research Council (as part of an MRC award to the MRC Lifecourse Epidemiology Unit (MC_UU_12011/4)); the Singapore National Research Foundation, National Medical Research Council (NMRC, NMRC/TCR/012-NUHS/2014); the National University of Singapore (NUS) and the Agency of Science, Technology and Research (as part of the Growth, Development and Metabolism Programme of the

Singapore Institute for Clinical Sciences (SICS) (H17/01/a0/005); and as part of Gravida, a New Zealand Government Centre of Research Excellence.

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