



Section A

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**Validity of anthropometric equations to predict body fat in exclusively breast-fed Sri Lankan infants aged 4-6 months, against  $^{18}\text{O}$  dilution technique**

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Anthropometric equations for predicting body fat based on the measurements of body weight, length, width, circumference, and skin-fold thickness have been developed since the early 1920s. In spite of the evolution of newer techniques, anthropometry is still the most widely used methodology to estimate the amount of fat in a human body. Validation of the body fat measured by the anthropometric equations against reference methods has been reported from both developed and developing countries. However, only a few of these have been conducted on infants. This study was designed to assess the validity of published anthropometric equations to determine body fat in exclusively breast-fed (EBF) Sri Lankan infants against the isotope dilution values.

Body composition was measured in term, healthy, EBF babies (n=25), aged 4-6 months, using the  $^{18}\text{O}$  dilution technique. Infants' body weight, length, skin-fold thicknesses (biceps, triceps, sub-scapular and suprailliac) and mid upper-arm circumference were measured following standard procedures. Infants' body fat was calculated using sixteen anthropometric prediction equations specified for infants and children, found in the literature. Bland and Altman pair-wise comparison method was used to evaluate the agreement of body fat generated using the anthropometric prediction equations against the  $^{18}\text{O}$  dilution values as the reference.

Mean ( $\pm$ SD) age, body weight and length of the infants were 4.5 months (0.8), 6.5 kg (0.9) and 64.7 cm (2.8) respectively. Mean body fat and % body fat (%BF) were 1.9 kg (0.5) and 29.5% (6.1), respectively as determined by  $^{18}\text{O}$  dilution. Equations of Hoffman *et al* (2012) and Durnin and Rahman (1967) resulted in totally unphysiological values [i.e. 279.6 (27.1) and -153.3 (7.9)] on Sri Lankan infants. When compared to the %BF of all infants measured by the  $^{18}\text{O}$  dilution method, only the Bandana *et al* (2010) equation resulted in a higher value (33.8% vs. 29.5%). The %BF predicted by the other equations were lower (ranged from 16.8% - 25.6%) than the isotope dilution value.

Most of the commonly used prediction equations yielded a bias which was not constant but a function of the %BF and therefore are not applicable for body fat measurements among Sri Lankan infants. Only three prediction equations [Bandana *et al* (2010), Goran *et al* (1996), and Durnin & Wormsley (1974)] yielded a constant bias but with wide limit of agreements. Durnin & Wormsely equation showed the smallest bias when compared to the  $^{18}\text{O}$  values with the narrowest limits of agreement. It was evident that the accuracy of some of these equations is a function of gender.

As none of the commonly used equations tested were found appropriate for the measurement of body fat among Sri Lankan infants, development and validation of new prediction equations are warranted.

Keywords: Body fat,  $^{18}\text{O}$  dilution, anthropometry, skin-fold thickness, infants

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