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# Prediction of body fat percentage from skin-fold and bio-impedance measurements in Indian children

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Anthropometry and bio-impedance analysis (BIA) are frequently used for estimating children's body composition in nutrition research. There are currently no equations in the literature for calculating BF% from skin-folds or BIA in South Asian children that have been developed using a four-compartment model of body composition. Given that South Asians tend to have a more adipose body composition than other ethnic groups for a given BMI, our objective was to investigate the agreement between Indian children's BF% values derived from a primary reference method and those predicted from published skin-fold and BIA equations.

We measured BF% using primary reference methods in two groups of Indian children. In Pune, West India, 534 children aged 6 years underwent Dual Energy X-Ray Absorptiometry (DXA) scans. We administered Doubly Labelled Water (DLW) to 59 children aged 9 years living in Mysore, South India and derived BF% according to age-specific values of hydration of fat free mass[(1)]. In both groups, at the time of BF% assessment, we measured sub-scapular and triceps skin-folds, weight, height and bio-impedance at 50 kHz using standardised methods. We used the published equations of Slaughter[(2)] and Shaikh[(3)] to calculate BF% from skin-folds and the 'Bodystat' manufacturer's equation[(1,4)] to do the same for BIA measurements. We tested the agreement between these calculated values of BF% and those derived from DXA and DLW using scatterplots and Bland Altman plots.

In Pune, the mean (SD) weight was 16.2 kg (2.2) and height was 110.0 cm (6.2). The mean (SD) BF% derived from DXA was 18.2% (4.5) for boys and 21.2% (5.2) for girls. The mean (SD) weight of the Mysore children was 24.1 kg (3.5) and height was 128.2 cm (5.6). BF% from DLW was 21.6% for boys (*n* 30) and 29.2% for girls (*n* 29). Scatterplots (Fig. 1) show the relationship between the BF% values derived from the primary reference methods and those from skin-fold equations. The Slaughter equations under-predicted the BF% of all children except for those with a BF% ≤ 10 as measured by DXA. The shaikh equations over-predicted body fat at lower levels of BF% and under-predicted at higher levels. There was no systematic bias for the BIA equations, although the limits of agreement (LoA) were wide (in Pune mean bias: +4.2LoA −6.6,16.0; in Mysore mean bias +1.95 LoA-7.84,11.74).

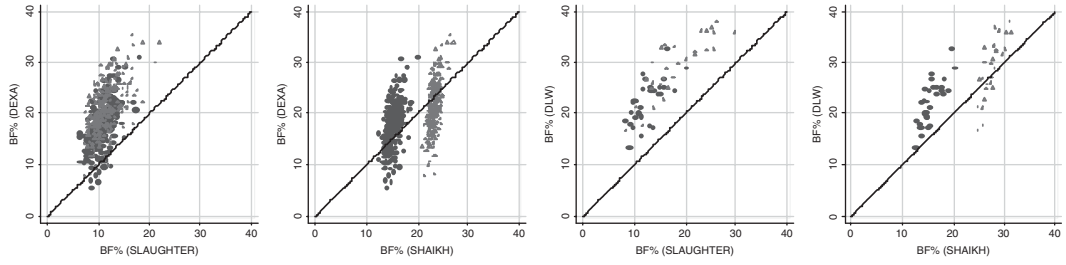


**Fig. 1.** Scatterplots of BF% from skin-fold equations by BF% from DXA and DLW.

Currently available equations for calculating body fat percentage from skin-folds in children do not accurately predict body fat percentage in these two groups of Indian children. We recommend that equations be specifically developed for South Asian children using a four-compartment model. The BIA equation predicts BF% most accurately at the group level and in the absence of new equations may be useful for investigating between-population differences or within-population changes over time.

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