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**Title:** Body mass index adjustments to increase the validity of body fatness assessment in UK black African and South Asian children: cross-sectional calibration study

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**Abstract**

**Background:** Excess childhood body fatness (BF), overweight and obesity represent a major UK public health challenge. Accurate assessments of these, usually based on body mass index (BMI), are crucial. However, recent studies demonstrated that BMI underestimates BF in South Asian children and overestimates BF in black African children. These errors are a concern in these ethnic minority populations, particularly UK South Asians with their high obesity, type 2 diabetes and cardiovascular disease risks. We aimed to develop BMI adjustments for these children to ensure adjusted BMI related to BF in the same way as for white European children.

**Methods:** Four recent UK population-based studies, which used deuterium dilution assessments of fat mass as a reference method, were pooled to include 1725 children (52% female), aged 4-12 years (mean age=9.3 years; SD=1.6), of white European, South Asian and black African origins. A height standardized fat mass index (FMI) was derived to represent BF. Linear regression models were fitted, separately by gender, to quantify ethnic differences in BMI-FMI relationships and to provide ethnic-specific BMI adjustments.

**Findings:** The FMI derived for this study population and used in analyses was fat mass/height5, which was independent of height for the 4-12 year age-group. BMI consistently underestimated BF in South Asians, requiring a BMI adjustment of +1.12kg/m2 (95% CI: 0.83, 1.41 kg/m2) for boys and +1.07kg/m2 (95% CI: 0.74, 1.39 kg/m2) for girls irrespective of age and FMI. BMI overestimated BF in black Africans. However, adjustments for Black African children were more complex, with statistically significant interactions between black African ethnicity and FMI (P=0.004 boys; P=0.003 girls) and between FMI and age group (P<0.0001 boys and girls). BMI adjustments therefore varied by age group and FMI level, between -0.24 and -2.84 kg/m2 for boys and between -0.22 and -2.86 kg/m2 for girls for unadjusted BMI values of 13 kg/m2 in 10-12 year-olds and 25 kg/m2 in 4-6 year-olds respectively.

**Interpretation:** BMI underestimated BF in South Asians and overestimated it in black Africans. Ethnic specific adjustments, increasing BMI in South Asians and reducing BMI in black Africans, can improve the accuracy of BF assessment in these children.

**(350 Words)**

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Data interpretation - MTH, PHW, ARR, CGO, DGC, JCKW

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**Competing interests:**

We declare that we have no conflicts of interest.