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Original Article

Untangling weight from height: A generalised body mass index (gBMI) approach to evaluating child and adolescent nutritional status in India

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Background and objectives: Weight-for-height (WHZ) and body mass index (BMI)-for-age (BAZ) are commonly used to assess child overnutrition but have limitations: they conflate skeletal growth with body weight, correlate with height, and inadequately distinguish fat from lean mass, particularly during puberty. This study proposes an India-specific generalised body mass index (gBMI), an age- and sex-specific power-type index adapted from Benn's concept, to better capture adiposity.

Methods: Exponent parameters for gBMI were estimated using healthy-child data, selected by WHO selection criteria, from the National Family Health Survey (NFHS-3,4,5) and the Comprehensive National Nutrition Survey (CNNS), comprising 12,466 children under 5 years and 6,487 aged 5–19 years. Polynomial regression to model age- and sex-specific variation in the weight–height relationship was used to estimate the exponents of height, and growth curves were generated using generalised additive models for location, scale, and shape (GAMLSS) with location scale and shape (LMS) methods. Validation employed independent data from 457 urban schoolchildren aged 5–16 years in Bengaluru, including fat and lean mass measured by dual-energy X-ray absorptiometry (DXA).

Results: The exponent varied with age (1.3 in infancy, ~2.9 in pubertal boys, 2.7 in girls, stabilising at ~2 in late adolescence). Unlike BMI, gBMI residuals showed near-zero correlation with height. gBMI-for-age Z-scores (gBAZ) showed lower wasting in children under 5 years (10.7% ***vs***. 19.2% using WHZ) and higher adolescent overnutrition (8.7% *vs*. <1% using BAZ). Validation showed stronger association of gBAZ with body fat (r=0.70) than BAZ (r=0.65).

Interpretation and conclusions: The gBMI provides an adaptable, height-independent, and adiposity-sensitive index for assessing malnutrition and obesity in children and adolescents. Its use could refine nutritional surveillance and interventions, with potential wider applicability with longitudinal evaluations.

Keywords Anthropometry; BMI; gBMI; Obesity; Z-score