INVITED COMMENTARY

Measuring Overnutrition in Children: Do We Know Enough?

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Given the historical rarity of excess weight, assessment of pediatric weight status has long been focused on detecting and correcting growth faltering in children. However, since the mid-1970s, changes in dietary intake and energy expenditure that favor excess weight began to take hold the world over. This nutrition transition was first evident in the weight status of adults and in high-income settings, but it is increasingly manifest in the youngest ones even in low- and middle-income countries (LMIC). Available data suggest that roughly 6% of children in LMICs experience overweight, an average rise of one percentage point over the past two decades [1]. The nutrition transition has created a challenging panorama of child health promotion priorities in places like India, which simultaneously has among the largest absolute number of overweight and growth stunted children [1,2].

Despite the nutrition transition, there has been relatively limited discussion on the best measure for the classification of overnutrition compared with the extensive debate regarding best measures of child undernutrition, including short stature (low height for age), wasting (low weight for height), and underweight (low weight for age). Currently, the WHO-recommended weight for height index is the predominant measure of child overweight and obesity in global settings [3]. Some have questioned whether weight for height is the most appropriate index for overweight and obesity.

In their recent publication in *Indian Pediatrics*, Naga Rajeev, et al. [4] compare body mass index (BMI) thresholds to define overweight, and the prevalence of overweight obtained from applying weight for height versus BMI for age. Through examination of NFHS-4 data, the authors report that weight for height compared with BMI for age yielded higher estimates of prevalent overweight from birth to 6 months, but lower estimates of prevalent overweight in children ages 6 months to 5 years. Similarly, their simulation studies showed that in short populations, the BMI threshold for overnutrition was lower for weight for height compared with BMI for age from birth to 7-8 months, but higher thereafter [4]. The discrepancies are more impactful in scenarios where child height is much lower than the global mean. The authors conclude that BMI for age is preferable to weight for height for the classification of overweight due to its ability to produce estimates that are not sensitive to the age or mean height of the population [4]. The authors are to be commended for the thorough and detailed statistical considerations of applying one measure rather than the other. Here, we provide two additional considerations for discussion to advance the measurement of childhood overweight.

First, the ultimate goal of assessing overnutrition and excess weight is to gauge excess adiposity. In that regard, BMI stands above weight for height because it breaks the relationship between the index and height because of the height-squared adjustment in the denominator. BMI for age additionally accounts for changes in body size over time (age). In this sense, BMI for age conceptually is a better index to capture changes in excess weight (and adiposity) independent of height [5,6]. The importance of the independence of different indices of body size and composition from their denominators has been demonstrated in previous studies in LMICs, where individuals and populations face a double burden of malnutrition [7,8]. Nevertheless, from previous research in children, it is known that BMI is still an imperfect measure of body composition (adiposity) [9].

Second, both debated definitions of child overweight and obesity are statistical in nature. Akin to the approach for classifying undernutrition, overweight definitions are based on distributional thresholds anchored to a universal reference population. Whether a distributional threshold is the optimal approach to capture future metabolic risk is unclear. In adults, excess weight is defined so that it captures excess risk of health outcomes such as death and cardiovascular events, and the field may consider whether anchoring excess weight in children against metabolic

outcomes would add value. There is some evidence that shows that both BMI for age and weight for height in infants predict future health outcomes with comparable validity [10], yet additional systematic investigation is needed to resolve which measure is best at predicting metabolic risk. Furthermore, following on the lessons from adult anthropometry and metabolic risk, the appropriateness of universal versus population-specific thresholds can be explored. For example, the WHO recommends lower "action point" thresholds for overweight and obesity in Asian adults because of observed elevated risk of diabetes and cardiovascular disease even in the normal weight range [11]. A similar exercise may enhance our ability to appropriately classify excess weight in children.

In summary, a measure of overweight should not only be statistically robust but also appropriately identify, categorize, and rank children with respect to excess adiposity and risk of future adverse health outcomes. Considering the results of Naga Rajeev, et al. [4], BMI for age offers a statistical robustness across varying ages. Additionally, recognizing that BMI for age is an inexpen-sive and practical measure to assess weight status in community and clinical settings, that BMI measures excess weight for height independent of height, and that BMI correlates with metabolic outcomes in children, we concur with the authors that BMI for age is a preferred index to classify childhood overweight given present knowledge.

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