

Relevance of Measuring Body Fat in Children

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The adverse health consequences associated with obesity are related to increase in body fat rather than body weight *per se*. Thus, it stands to logic that measuring body fat would be a better tool for identifying risk as compared to any indirect measures of adiposity. Accurate measurement of body fat can be done by various techniques like under-water weighing, dual energy X-ray absorptiometry (DEXA), bioelectric impedance, etc. In recent times, DEXA has emerged as a tool of choice for body composition studies. However, use of these methods is largely restricted to research settings because of their complexity and cost. In clinical setting, anthropometric measurements such as skin fold thickness, waist circumference, waist-stature or waist-hip ratio and various height and weight-based indices like body mass index (BMI) are the common tools used to assess adiposity and its related complications.

Body mass index has been validated as a simple, low cost tool to assess body fatness for routine clinical evaluation in children and adolescents [1], and is found to be strongly correlated with adiposity [2]. Increasing BMI is also shown to be associated with higher risk of metabolic complications [3]. However, BMI criteria for obesity may not identify differences in body fat or their distribution [4]. Thus, BMI is an appropriate screening test to identify children requiring further evaluation and follow-up, though it may not be diagnostic of the level of adiposity. Attempts have been made to link percentage body fat (PBF) estimates derived by DEXA with BMI and describe PBF values associated with BMI classification of over-weight and obesity [1]. There are age-related and sex-related variations in PBF and thus a single PBF value may not be suitable for classifying children as over-weight or obese.

As an ethnic group, Asians tend to have a smaller body size and a relative deficit of lean body mass as compared to Europeans/Americans. Thus, at an equivalent body mass index (BMI), there is a relative excess of body fat in Asians. They also tend to have a more central rather than peripheral distribution of fat. These differences in body composition are evident from childhood and become more pronounced during adolescence. Shaw, *et al.* [4] from UK demonstrated that from age of 5 years onwards, South Asian girls and boys have higher PBF as compared to the White or African

Caribbean ethnic groups, the difference increasing with age. This relative excess of adipose tissue at a given BMI makes Asians more predisposed to metabolic complications like type 2 diabetes (T2DM), hypertension and dyslipidemia [5]. These disorders also tend to occur at a lower BMI in Asians as compared to their Western counterparts [6]. Like the increase in body fat, the risk of metabolic complications also starts becoming evident from adolescence itself. In UK, the relative risk of developing T2DM in childhood is reported to be 14 times greater in South Asian than in White European children [7]. In another study from UK, children of South Asian origin were reported to be more sensitive to adverse metabolic effects of obesity than Caucasians [8], which also tend to occur earlier in age in children of South Asian origin [9].

Though elevated body fat in Asian children and adolescents residing in Europe and America has been well documented, the study by Khadgawat, *et al.* [10] is the first large study from India that has systematically measured PBF in children and adolescents using DEXA. It brings out a few important points. Most importantly, it shows that there is a high correlation between BMI and body fat in both boys and girls (all boys: $r = 0.76$, $P < 0.0001$; all girls $r = 0.81$, $P < 0.0001$). Thus, it reiterates, to the relief of clinicians, that BMI, with all its limitations, remains a valid tool for assessing obesity and its related complications in clinical practice. Interestingly, the authors show that there was no consistent relationship between BMI and PBF categories. Thus, 6.3% children in normal BMI category showed moderate/excess body fat, 32% of those in obese category by BMI showed normal/moderate body fat and 41% of those in the over-weight category by BMI showed variation in either direction. Overall, there was moderate agreement between BMI and PBF categories and PBF seemed to pick up less children in higher categories of adiposity as compared to BMI. Secondly, the study quantifies age- and sex-related changes in PBF in children and adolescents and gives their distribution in the study population. While likely to be of limited clinical utility, the data will serve as a reference data for North Indian children in research studies for intra-country and international comparisons. Finally, it formally documents what studies from West have been indicating- Indian boys and girls have higher

PBF as compared to American children. This difference is more obvious during adolescence and in the higher centiles of PBF distribution. Stated simply, Indian children, especially those who are obese and/or in adolescent age group, have more PBF as compared to their American counterparts and are therefore at a higher risk of obesity related metabolic complications.

While definitely a cause for concern, one should keep in mind that this work has been done in North Indian affluent school children. This group had a higher prevalence of overweight and obesity than the country on the whole. In India, where obesity is still a phenomenon predominantly restricted to the urban affluent, findings of this work may be applicable to other children from similar background; populations where obesity/overweight prevalence is lower may not show similarly high PBF. In fact, they have found lower PBF than that in American children in the lower centiles, thereby indicating that thinner Indian children may actually have less PBF as compared to their Western counterparts [10].

So what is the clinical relevance of this documentation of increased body fat in Indian children? Few studies till now have directly assessed magnitude of health risk associated with excess body fat in children [11,12] and it is not known as yet if measurement of PBF is superior to BMI in determining health risks. Till this risk is quantified, BMI firmly retains its position as a valuable clinical tool for pediatric practice.

Competing interest: None stated; *Funding:* Nil.

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