Differences in Classification of Overweight/Obesity by BMI Percentile versus Percent Body Fat in Youth with Type 1 Diabetes According to Pubertal Status

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Introduction: Type 1 Diabetes (T1D) is a chronic condition that commonly manifests in childhood and poses a significant risk for morbidity and premature mortality, primarily due to macrovascular complications. Presence of overweight and obesity are a well-recognized risk factor for cardiovascular disease; moreover, youth with T1D are concomitantly susceptible to the current global epidemic of childhood overweight and obesity. As the rates of both T1D and overweight/obesity are rising worldwide, the ability to identify overweight and obese status in those with T1D is of utmost importance, in order to provide timely intervention. Body mass index (BMI) is utilized worldwide to assess overweight and obesity in children and adults alike; however, its utility in estimating adiposity in developing children warrants investigation.

Objectives: We sought to evaluate concordance in classification of overweight/obesity by BMI percentile compared with percent body fat by DXA in youth with T1D according to pubertal development at baseline and after 12 months.

Methods: To calculate BMI (weight[kg]/height[m]^2), height and weight were assessed from calibrated electronic stadiometers and scales. BMI ≥85th to <95th percentile was classified as overweight. BMI ≥95th percentile was classified as obese. Percent body fat was assessed by Dual-energy X-ray Absorptiometry (DXA), the gold standard for body composition analysis. Overweight/obesity by DXA analysis was based upon age- and sex-specific standards (Taylor et al, Am J Clin Nutr 2002;76:1416-21).

Results: At baseline, the 115 participants (50% female, 11% non-white) had a mean±SD age of 12.9±2.5 years and T1D duration of 6.1±3.2 years; 33% were pre-pubertal (Tanner 1), 41% pubertal (Tanner 2-4), and 26% post-pubertal (Tanner 5). The mean BMI percentile was 70±23, while the mean percent body fat by DXA was 27.7±7.9%. At baseline, 31% were classified as overweight or obese by BMI, while 51% were overweight or obese by DXA analysis. Concordance in overweight/obese classification between BMI percentile and DXA was 53%, 68%, and 60% at baseline in pre-pubertal, pubertal, and post-pubertal youth, respectively. At baseline, adiposity was most likely to be underclassified by BMI compared with DXA in pre-pubertal youth (42% underclassified), while it was most likely to be overclassified by BMI compared with DXA in post-pubertal youth (23% overclassified). After 12 months, 32% of the sample was overweight/obese by BMI (similar to 31% at baseline), while 63% were classified as overweight or obese by DXA (compared with 51% at baseline). Concordance in overweight/obese classification was 43%, 50%, and 66% at follow-up in pre-pubertal, pubertal, and post-pubertal youth, respectively. At 12 months, adiposity was most likely to be underclassified by BMI compared with DXA in pre-pubertal youth (57%), while most likely to be overclassified by BMI compared with DXA in both pubertal and post-pubertal youth (10% and 9% respectively). This data suggests that BMI may underestimate the proportion of youth with T1D who are overweight/obese, indicating a need for cautious interpretation of BMI in clinical practice. As a large number of youth worldwide suffer from T1D, at a rate which continues to increase, it is paramount to correctly identify adiposity in order to implement timely risk factor reduction.