

Defining Central Adiposity in Terms of Clinical Practice in Children and Adolescents

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The global increase of overweight and obesity in childhood and adolescence requires intensified efforts for early detection and prevention.¹ Increased central (abdominal) adiposity has a special importance because of increased risk of cardio-metabolic disorders.² Waist circumference (WC) is the best simple index of fat distribution, since it is least affected by gender, race, and overall adiposity.³ WC correlates with intra-abdominal and subcutaneous fat measured by magnetic resonance imaging in youths.⁴ Increased WC is one of the five diagnostic items of the metabolic syndrome (MetS) which is essential for the definition of the International Diabetes Federation (IDF) in terms of increased WC plus 2 out of the followings: elevated fasting plasma glucose, hypertension, elevated triglycerides and low HDL-cholesterol (HDL-C).⁵

In adults, WC is measured and adjusted in terms of gender. However, in children and adolescents, additional adjustment for age is required because of physiological growth and development. Therefore the cut-off values are presented as percentiles similar to the $\geq 85^{\text{th}}$ percentile of the body mass index (BMI) considered for overweight which can be transformed using special growth charts. Sites of measurement have to be identical for intra-individual, inter-individual and interethnic comparisons. Among the four sites generally used, the best site might be the midway between iliac crest and the lower ribs taking a non-stretchable tape and measuring in the horizontal plane directly on the skin to the nearest 0.1 cm in a relaxed standing position with slight expiration.^{6,7} Because of ethnic differences in body composition, IDF proposed special pragmatic cut-off values for WC of European, South Asian, Chinese and Japanese adults.⁸ However, global proposals are not still well defined for youths though more national data become available.^{9,10} For instance, components are documented for Iranian and German children ethnic disparities of the metabolic syndrome.^{11,12} Among black and white children participating in the Bogalusa Heart Study between 1992 and 1994, WC thresholds were similar in both confirming consistent evidence that WC is related to cardiovascular disease (CVD) risk factors in children and adolescents.^{13,14} In developing countries, the highest prevalence of childhood overweight is reported from Eastern Europe and the Middle East, whereas India and Sri Lanka have the lowest prevalence.¹⁵

Another practical indicator of body fat pattern to assess pediatric central adiposity is the waist-to-height ratio (WHtR) predicting CVD risk in children and adolescents from Greece,¹⁶ Japan,¹⁷ USA,¹⁸ Hon Kong¹⁹ and Germany.²⁰ Among 7,657 (3,777 boys) 4 to 17-year-old youths from USA, the mean WHtR was 0.463 ± 0.002 (median 0.451) which was not significantly different considering gender or age.¹⁸ Combining high WC ($\geq 90^{\text{th}}$ percentile) and WHtR (≥ 0.5), representing central adiposity, would predict a 3.8 fold increase in CVD risk.²⁰ WC increases with age; but WHtR seems not to be affected by age. WHtR is suggested as the best indicator of central adiposity in both genders of adolescents.²¹

Children with WHtR values more than the BMI percentiles have a greater ratio of subscapular to triceps skinfold thickness (SFT) corresponding to increased central subcutaneous fat.¹⁸ Compared with BMI, triceps SFT was better for screening of central obesity in Portuguese children.²² In another study on 6-12-year-old children in Swiss, the body fat percentage calculation based on 4 SFT was 40-50% more sensitive than the International Obesity Task Force (IOTF) definition of obesity.²³ Because SFT is more strongly associated with body fatness, it is proposed to be the best predictor for increased risk of CVD. In fact, the sum of subscapular and triceps SFT was significantly associated with the sum of 6 traditional CVD risk factors.²⁴ However, accurate measurement of SFT requires careful training and is limited in obese youths.²⁵ Recently reference curves for SFT in youths from Germany, Spain and USA have reported.^{21,26,27}

In conclusion, WHtR would serve better than WC for identifying central adiposity and CVD risk factors, whereas both might be better than BMI and SFT in this regard. Since WHtR is independent of age, the term "Keep your waist circumference below half of your height" can easily kept in mind.¹

Conflict of interest statement: All authors declare that they have no conflict of interest.

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