Estimating Blood Pressure in Children and Adolescents: Should Body Weight be Included?

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Editorial

Because growth and development affect anthropometric variables including, height, body weight, body mass index (BMI), waist circumference (WC), skin-fold thickness, and the blood pressure (BP) age- and sex-specific growth curves have to be established in children and adolescents. Furthermore, comparisons of multiethnic populations must regard ethnic differences including, genetic, environmental, and life-style factors. Therefore, all reference tables among youths should be region-specific.

In terms of BP, this translates into adjustment of age- and sex-specific percentile references for weight, height, BMI, and ethnicity. The prevalence of hypertension and overweight has increased most notably among ethnic minorities hypertension being more prevalent in disproportionately overweight Hispanic US children.[1] The prevalence of hypertension and obesity was considerably higher in children of migrants from the former Soviet Union born in Nuremberg (Germany), than in German children living in Nuremberg that might be due to environmental effects.[2] US children and adolescents from four ethnic groups were recruited for the National Health and Nutrition Examination Survey to provide national standards for the diagnosis, evaluation, and treatment of high BP.[3] Because this database included overweight children these norms for BP will continue to increase as the level of overweight and obesity changes over time that was the case with the current epidemic.[4] Therefore, the normative database was modified by excluding youths who were either overweight (BMI 85th-95th percentile) or obese (>95th percentile) resulting in slightly lower pre-hypertensive (≥90th percentile) and hypertensive (≥95th percentile) levels.[5] In fact, obese children from the USA were at an approximately three-fold higher risk for hypertension.[6] Obesity in terms of elevated BMI is strongly associated with the elevated BP in the many ethnicities.[7-11] A strong positive relationship between BP and percentage body fat was described among Chinese children.[12] In German adolescents, we found a significant age- and gender adjusted odds ratio between hypertension and general obesity (4.9; 95% CI 2.8-8.4) respectively central adiposity (2.5; 95% CI: 1.8-3.5).[13] This is consistent with the association of elevated BP and elevated waist-to-height ratio in Chinese first graders displaying an odds ratio of 4.19; 95% CI 2.60-6.76.[14]

However, discordant secular trends in elevated BP and obesity were observed in children and adolescents. Secular trends in national US surveys from 1963 to 2002 demonstrate that obesity increase partially explained the rise in high BP and prehypertension between 1988 and 1999.[15] Among youths of the rapidly developing African Seychelles, the prevalence of elevated BP decreased whereas, the prevalence of obesity increased.[16] In South-Korea mean Systolic blood pressure

(SBP) decreased by 8.7 mm Hg among boys and by 10.0 mm Hg among girls and the prevalence of elevated BP decreased by 52% between 1998 and 2008.[17] This secular decline in BP is not explained by concomitant secular changes in childhood obesity, health behavior, nutritional intake psychological, and socio-demographic factors. This was actually supported by a large study in 9-11-year-old children in the United Kingdom 1980-2008 demonstrating that mean SBP annually increased by 0.45 mm Hg in boys and by 0.51 mm Hg in girls whereas, mean BMI increased per year by 0.064 kg/m² for boys and by 0.070 kg/m² for girls. BMI explained only 15.3% of increases in SBP for boys and 14.9% for girls an association that has significantly weakened over time;[18] however, the increment in both BP and BMI is greater than in the previous studies.

Thus, the still unresolved question is the suitability of adjusting BP reference values to BMI. Because BMI is an incomplete measure of body fat, other measures of fat patterning like estimation of percentage body fat or ascertainment of WC and/or waist-to-height ratio for central adiposity.[19]

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