Adiposity in Youth and Blood Pressure

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The metabolic syndrome is a constellation of several traits that often coexist and augment risk for atherosclerotic disease, diabetes mellitus, and other conditions. The article by Srinivasan et al in this issue of Hypertension reports on changes in blood pressure over time in persons according to metabolic syndrome trait status, and the authors focus on issues related to adiposity. They highlight the longitudinal blood pressure experience of the Bogalusa Study in pediatric, adolescent, and adult age groups. The authors conclude that higher prehypertension is likely to be accompanied by increased adiposity; other metabolic abnormalities, such as elevated triglycerides, higher low-density lipoprotein cholesterol, and higher insulin levels accompany frank hypertension.

Previous research has shown that weight gain in the Framingham Offspring population sample was a key contributor to the development of increasing systolic and diastolic pressure and the occurrence of hypertension over an 8-year follow-up interval.2 A later Framingham Offspring study with 16 years of follow-up showed that greater adiposity at baseline and weight change were both highly related to the degree of metabolic risk factor clustering.3 The mean number of metabolic factors increased significantly in those who gained >5 pounds over the study interval compared with persons whose weight remained stable. The Framingham analysis was largely based on the experience of a white middle-aged population group, and the current article by Srinivasan et al finds similar relationships in younger individuals and includes blacks.

The top of Table 4 in the article by Srinivasan et al provides a strong and simple message concerning blood pressure and adiposity in youth. They defined excess adiposity as either a body mass index (BMI) ≥30 kg/m² or an increased waist circumference, and adiposity was present in 12% to 21% of normotensive persons, ≈36% to 37% of those who were prehypertensive, and 52% to 58% of those who were hypertensive. These results are strongly suggestive that weight control and avoidance of obesity would reduce the prevalence of hypertension in middle-aged adults. The information on average BMI and subscapular skinfold levels in Figure 2 of the article by Srinivasan et al shows that these relations seem to be set at an early age and are identifiable in children in the 4- to 11-year age bracket that they studied. Other metabolic traits are frequently abnormal at early ages in comparisons among persons with normal blood pressure, prehypertension, and hypertension, but the consistency of the very strong relation between excess adiposity and blood pressure is rivaled only by triglyceride levels. The overall interpretation that excess adiposity measured by BMI or central adiposity assessed by subscapular skinfold are key determinants of higher blood pressure appears at an early age.

Hypertension has been a controversial element in the metabolic syndrome, and the results reported by Srinivasan et al suggest that greater adiposity in younger age groups provides a critical connection between greater blood pressure levels and other elements of the metabolic syndrome. A factor analysis of the components of the metabolic syndrome undertaken by Meigs et al showed that the core central components for the metabolic syndrome were adiposity (increased BMI or waist girth), low high-density lipoprotein cholesterol, high triglycerides, and hyperinsulinemia. Hypertension was not a component of the central syndrome, and it was associated with the central core largely by virtue of shared variance components with BMI.

Evidence for a connection comes from an analysis of trends in blood pressure levels for the Third National Health And Nutrition Examination Survey (NHANES III) that took place in 1988–1994 and NHANES 1999–2000.4 The authors concluded that “systolic and diastolic blood pressure has increased substantially among children and adolescents in the United States. The increase in BMI during this same period accounted for some of the increase in blood pressure.”5 The national trends suggest that overweight in children is increasing, and hypertension prevalence is rising as well. Dietary interventions, greater physical activity, and weight control in youth are key considerations to potentially reverse these trends, and experts have called for more dietary studies of blood pressure in children and adolescents.6,7 Potential dietary modifications are likely to consider lower sodium and increased potassium intake; Dietary Approaches to Stop Hypertension (DASH)-type nutritional features with a diet rich in fruits, vegetables, low-fat dairy products, and reduced fat and cholesterol; and moderate alcohol intake.

Excess adiposity, obesity, and abdominal bulges in the pediatric and adolescent age group are not innocuous. The increased adiposity accelerates the development of higher blood pressure and hypertension, clustering of metabolic risk factors, and augmented risk for type 2 diabetes mellitus. Most of these problems are avoidable with lifestyle interventions, community and school programs that promote health and normal weight for height, and increased cooperation and active collaborations between healthcare providers and industry leaders concerning nutrition and physical activity.

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