Cardiovascular disease is the leading cause of death worldwide and represents an increasing burden to healthcare systems. Among the modifiable risk factors for cardiovascular disease, hypertension (HTN) is the most important, attributable not only to its high prevalence, but also to its impact on accelerated atherosclerosis. Although most of the adverse outcomes occur in adulthood, HTN is a lifelong problem that can be progressive from childhood into adolescence and adulthood. It is well accepted that blood pressure (BP) values in children represent one of the most important measurable markers of cardiovascular risk later in life, despite the definitions of HTN based on percentile distribution by age, sex, and height, and not on events. Although pediatric HTN may be secondary to another disease process, essential HTN accounts for the majority of children and adolescents with mild-to-moderate HTN.

In recent years, considerable advances have been made in identifying factors often associated with, and considered responsible for, high BP in children and adolescents. Among them, the environmental ones are the most interesting for public health, because they can change over time and are modifiable. Lifestyle, physical activity, and dietary habits, which contribute to body weight and composition, account for the majority of the environmental factors. Overweight is probably the most important of the conditions associated with elevated BP in childhood. Fatter children are known to be more likely to remain fat, and adiposity is the most powerful risk factor for higher BP. In addition to body mass index, waist circumference has been shown to play a role, as has salt intake. Secular trends in both overweight and salt intake, and their relationship with BP changes, are of particular interest in light of the potential for prevention and management of HTN, ensuring the health of young people today and of the adults of tomorrow.

Although it is important to know secular trends in BP values, discrepancies among studies have been reported. While some of the studies of BP trends in children and adolescents have identified an increment in BP values over time, others have reported a decrease. It is the issue of the methods of measurement (device used, appropriate cuff sizes, number of BP readings, setting and position of the subjects), the inequalities in population samples (age distribution and stage of puberty among study place and ethnicity), and the adjustments performed during the analysis (age, body mass index, and height, among others). When measurements and analysis are not standardized over time across countries, it can lead to confusion about whether the observed differences are real or are artefacts, raising concerns about the findings.

In the current issue of Hypertension, Rosner et al performed a study in which they examined the secular trend of BP among children and adolescents and risk factors for high BP. In a representative sample of the US pediatric population aged 8 to 17 years, the authors observed an increase in the prevalence of elevated BP from National Health and Nutrition Examination Survey (NHANES) III to NHANES 1999–2008, 2 surveys 12 years apart with identical BP protocols. The authors concluded that the risk for having elevated BP, both prehypertension and HTN, increased by 27%. Concurrently, the percentage of overweight was higher, and there were also increases in waist circumferences and salt intake. Consequently, the BP elevation was attributed to a subsequent increase in obesity, waist circumference, and sodium intake over time.

The potential causal relationship between obesity and fat distribution in the increment of BP has been analyzed in previous studies performed in the United States using NHANES data from different periods. Muntner et al identified an increment in BP values between the NHANES III 1988–1994 and the NHANES 1999 to 2000 surveys. Systolic BP values increased an average of 1.4 mm Hg, and diastolic BP values increased by 3.3 mm Hg. After adjustment for differences in body mass index, the increment in systolic blood pressure was reduced by 29%, and diastolic blood pressure was reduced by 12%, therefore the increase was partially attributable to an increased prevalence of overweight. Ostchega et al, analyzing the data from 3 time periods of NHANES performed in 1988 to 1994, 1999 to 2002, and 2003 to 2006, observed a rise in the prevalence of high BP in girls, but not in boys, with a strong association to body mass index increase. Din-Dzietham et al, using NHANES data from 1963 to 2002, added interesting information such as the prevalence of elevated BP being on the rise since the late 1980s. Moreover, the BP rise lags ≈10 years behind the increase in obesity. Therefore, it seems to be that changes in body mass index that have been occurring continuously since 1980 may play an important role in the prevalence of elevated BP.

The importance of changes in salt intake, a relevant issue in BP elevation, merits particular attention. Largely

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because of secular changes in dietary patterns, Na intake has increased in the US childhood population. The findings in this report demonstrate an association between high Na intake and elevated BP, which was stronger among the overweight/obese subjects. This is similar to the findings published by Yang et al16 assessing children and adolescents aged 8 to 18 years who participated in NHANES 2003 to 2008.

The study offers relevant information for future preventive strategies, although it should be interpreted with its strengths and limitations in mind.11 Elevated BP was assessed using norms based on normal-weight children, and this has resulted in higher rates of prehypertension and HTN, albeit the percentage of increment is not affected by the threshold to define high BP. The inclusion of prehypertension in the analysis is relevant as a result of the evidence developed in recent years, which demonstrates that prehypertension is not an entirely benign condition and raises the question as to whether the 95th percentile criteria for HTN in children sufficiently captures current and subsequent cardiovascular disease risk. Concerning sodium intake, a potential bias should be considered. It was assessed using a single 24-hour recall, and validation by 24-hour analysis was not possible. Moreover, there was a shift in the ethnic distribution between surveys, with a significant decrease in the percentage of non-Hispanic whites and a significant increase in the percentage of Mexican Americans. Finally, other potential factors, such as changes in physical activity, cigarette smoking, and change in caffeine consumption have not been measured.

Even so, these limitations do not minimize the strengths of this study.

The need for a population-based approach to reduce HTN is clear. Even after decades of research, the optimal approaches to the control of BP levels from early life onward are not clear. The study performed by Rosner et al11 provides support for public health strategies to reduce weight and salt intake in childhood. This may lead to a greater-than-expected future reduction in high BP prevalence among children and adolescents.

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**References**

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