Salt Intake in Childhood and Adolescence

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Salt (sodium chloride) is an essential nutrient whose main role is to preserve the extracellular volume and hence contribute to the maintenance of an adequate circulatory volume. The crucial role of salt in maintaining volume is underscored by the fact that our kidneys have evolved over millions of years to become exquisitely efficient in prioritizing sodium conservation over all of the many regulatory functions of the kidney. This capability of our kidneys to retain salt was particularly important in ancient times when the availability of salt was scarce. However, as time passed, salt production increased and it became readily available to the general population. Eventually, the use of salt extended beyond food seasoning to food preservation. This led to remarkable increases in sodium consumption in most regions around the world; the reason being certain more primeval societies.

There is abundant epidemiological evidence linking sodium intake to high blood pressure. Societies with a high salt intake tend to have a significantly higher rate of age-related increase in blood pressure, whereas those with low sodium intake, such as the Yanomamo Indians of northern Brazil who have intakes of <3 g/d, are associated with lower sodium intake, such as the Yanomamo Indians of northern Brazil who have intakes of <3 g/d, are associated with lower age-related blood pressure elevations. These trends are not just in adults. Studies in the United States have demonstrated that higher salt intake in children and adolescents is positively correlated with high systolic blood pressures and an elevated risk of prehypertension/hypertension. Indeed, such a notion aptly fits Guyton’s hypothesis, in that blood pressure goes up to achieve sodium balance through increased natriuresis. Although this increased natriuresis restores sodium balance and prevents cardiopulmonary congestion in the short term, it does so at the expense of the long-term complications of high blood pressure. Moreover, salt may also affect outcomes via other mechanisms. For instance, we and others have shown that excessive salt intake can promote proinflammatory signaling, which has the potential to accelerate cardiovascular disease. The clinical relevance of this finding is supported by published (albeit controversial) epidemiological data that point to a relationship between habitual salt intake and cardiovascular complications. In brief, there is strong evidence suggesting that high salt intake is linked to hypertension and cardiovascular disease. Hence, it is critical that we target excessive dietary salt consumption to mitigate the burden of cardiovascular disease.

For these reasons, researchers have made substantial efforts to quantify sodium intake in hypertensive individuals as well as normotensive populations. Unfortunately, this is a difficult task in most cases. Measuring the 24-hour urinary salt excretion is the gold standard to accurately estimate dietary salt intake; the caveat here being that the subjects must have proper sodium homeostasis. However, this method suffers from great individual variability resulting not only from incomplete collections, but also from the inconsistencies in day-to-day salt intake, physical activity, environmental temperature, ambulation, and other factors. Moreover, because of this individual variability, regression coefficients tend to underestimate correlations attributable to regression dilution. For these reasons, multiple urinary sodium measurements are recommended but cumbersome to obtain.

The barriers to accurately quantifying salt consumption in the pediatric population are especially prominent. Particularly because obtaining accurate 24-hour urine collections in this population can be an especially challenging task. The reasons for this are numerous. For instance, children find it inconvenient (and embarrassing) to collect urine while they are away from home. In addition, the long collection times increase the chances of intuitive voiding. That is, for most persons, bladder emptying is an automatic process. Incidental issues distract their minds, and they may not remember to collect the urine when they get the urge to urinate. Moreover, while defecating, they may unconsciously empty their bladder. Although these potential faults in urine collections seem less likely when the patient stays at home and keeps the container or a reminder in the rest room, they are not completely avoided. This difficulty in obtaining accurate urine collections is one of the reasons that there are scant high-quality publications that evaluate salt consumption in the pediatric population.

In this issue, Marrero et al present data on salt intake of children and adolescents living in London, whom they divided into 3 age groups as follows: 5- to 6-, 8- to 9-, and 13- to 17-year olds. To better estimate salt consumption and avoid the pitfalls of previous studies, the investigators not only obtained conventional 24-hour urine collections, but they also used the more novel approach of using cameras to help the participants maintain a photographic food diary. This helped the investigators keep a tab on the various sources of salt in the diet of the subjects (beyond the use of table salt). Consequently, although the authors could not completely escape the flaws inherent to these 2 techniques for estimating salt intake, they likely mitigated their impact by using both techniques concurrently. In fact, any error emerging in the reported salt intake is likely an underestimation of the
actual salt intake. In other words, quite likely these children and adolescents are in fact eating more salt than what appears from the results. Their data represent an important contribution to the growing evidence suggesting that salt intake is excessive among children of these age groups. In addition, although it is well established that processed foods tend to be heavily laden in salt, Marrero et al. demonstrate that the consumption of processed foods is a major contributor to the excessive salt intake in children. It is important to note that although the main limitation of the study is still inaccuracy of data collection by the test subjects, any error that arises is likely to be an underestimation of the actual salt intake; that is, these children and adolescents may be eating more salt than what appears from the results. Thus, this limitation would not invalidate the author’s conclusions.

Studies such as the one by Marrero et al. suggest that our children and adolescents are consuming too much salt, but they raise a more challenging question, which is how much is too much. This unresolved issue is explored at length in editorial comments in the October 2013 issue of the American Journal of Hypertension.

Marrero et al. compared the salt intake in their study subject with the standard sodium intake recommendations suggested for children and adolescents and found that the sodium intake exceeded these criteria. However, it is important to note that these recommendations are only empirical estimates. Evidence-based guidelines would require a prospective intervention trial in children, such as the Intersalt study for adults. Unfortunately, these studies are difficult to complete because of several factors, not the least of which is that studies in the young would require many more years of follow-up (as compared with adults) before differences in cardiovascular outcomes become evident. Consequently, ideal sodium intake in children and adolescents remains undefined.

Despite the lack of prospective, long-term comparisons between various salt intakes in children and adolescents, salt intakes as high as those reported by Marrero et al should currently not be regarded as safe. I base this on the available epidemiological data that suggest long-term detrimental effects of high salt intake and on the overall safety profile that salt restriction has in most patients. Consequently, although ideal sodium intake in children and adolescents is undefined, the beneficial effects of moderate salt restriction seem to exceed the potential deleterious effects that are usually predictable. Thus, it seems reasonable to recommend moderation in dietary salt. The work by Marrero et al clearly shows that children are receiving unnecessary salt loads and that they are receiving it from food products that are linked to additional health risks such as obesity. Strategies aimed at reducing their day-to-day consumption of these salt-rich foods (and consequently of their associated detrimental effects) would seem to be a sounder policy than waiting until they get old and sick.

Disclosures

None.

References
