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Is modifying salt intake an effective treatment strategy for hypertension control?

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Salt and fluid intakes are essential physiological determinants of blood pressure (BP). Numerous epidemiological studies have demonstrated a significant association between salt intake and BP, the most recent being the Prospective Urban Rural Epidemiology study, which included 102 216 adults from 18 countries [1]. Meta-analyses and systematic reviews have also demonstrated that salt intake is associated with an increased risk of cardiovascular complications, mainly stroke.

REDUCING SALT INTAKE IS EFFECTIVE TO LOWER BP IN HYPERTENSION

Considering that an elevated BP is a major risk factor for cardiovascular and renal diseases, all international guidelines recommend limiting salt intake to <5–6 g sodium chloride (NaCl)/day in order to prevent high BP and cardiovascular diseases. In the last 20 years, several meta-analyses have assessed the impact of reducing salt intake on BP in normotensive and hypertensive subjects. In randomized trials with a modest reduction in salt intake and a sufficient duration (at least 4 weeks), the reduction in systolic BP averages 5.5 mmHg for subjects with hypertension and 2.4 mmHg in normotensive subjects [2]. However, the BP reduction induced by lowering salt intake varies substantially depending on several factors, including the level of achieved salt reduction, baseline salt intake, patients' age, gender and ethnicity and finally the baseline level of BP. All these factors have been examined in a very recent systematic review and meta-analyses of randomized trials that included 133 studies with 12 197 participants [3]. Results show that the impact of a reduction in salt intake on BP is proportional to the magnitude of the difference in salt intake (Figure 1), but also that the impact of lowering salt intake is greater in older patients (>55 years) and those of African descent. Interestingly, for a similar decrease in salt intake, the decrease in BP was greater in subjects with an elevated baseline BP (Figure 1).

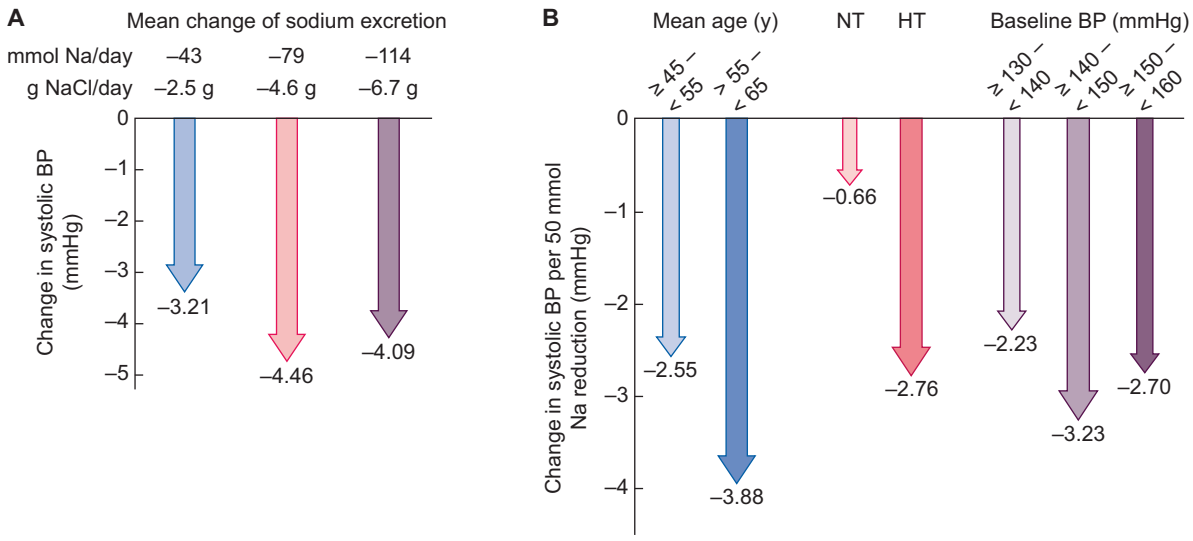

FIGURE 1: Effect of reducing salt intake on BP. (**A**) Decreases in systolic BP induced by three different magnitudes of salt reduction corresponding to −2.5, −4.6 and −6.7 g of NaCl. (**B**) Decreases in systolic BP induced by a 50 mmol (−2.6 g NaCl) reduction of sodium intake according to age, normotension (NT), hypertension (HT) or baseline BP. Figure adapted from Huang *et al.* [3].

Thus, for every reduction of 50 mmol of sodium excretion, the decrease in BP was −2.23 [confidence interval (CI) −2.89 to −1.57] mmHg for subjects with a baseline systolic BP between 130 and 140 mmHg and −2.97 (CI −4.34 to −1.60) mmHg for those with a systolic BP >160 mmHg. Patients with chronic kidney disease were excluded from this analysis. These findings reinforce the recommendation that reducing salt intake is an effective way to lower BP, and an important observation is that salt reduction is particularly effective in those presenting the higher risk of developing cardiovascular complications. Of note, in the absence of sufficient data from long-term studies, authors could not demonstrate an effect of the intervention duration on the size of the BP decrease obtained while reducing salt intake [3].

WHAT ABOUT THE POTENTIAL MORTALITY RISK OF A LOW SODIUM INTAKE?

A reduction of salt intake in persons with a normal BP has been associated with an increased risk of mortality in some studies [4]. Yet, as of today, the clinical characteristics of subjects at risk of dying because of a low sodium intake are not well defined and the mechanisms linking a low sodium diet to a higher mortality remain hypothetical. The possibility of a reverse causation and the impact of confounding factors or methodological artefacts cannot be formally excluded. In this context, He *et al.* [5] published an interesting analysis providing important insights on the artefacts produced by the use of estimated sodium intake based on a single spot urine specimen and artefacts that appear to modify the link between sodium intake and mortality risk. Using the data of Trials of Hypertension Prevention, authors have compared the relation between measured and estimated sodium intake using three different formulas and mortality. The analysis demonstrates a significant linear association between the averaged measured sodium intake (three to seven measurements of 24 h sodium excretion) and mortality, whereas the use of estimated sodium intake leads to a J- or U-shaped relationship whatever the formula is. Additional analyses suggest that other variables in the formulas such as age, gender, body weight and urinary creatinine concentration may actually bias the relationship with mortality because they are also associated with the mortality risk. The authors conclude that estimated sodium intake using formulas is an inadequate approach to investigate the association of sodium intake and mortality.

IMPACT OF REPLACING SODIUM WITH POTASSIUM IN LOW-SODIUM SALT SUBSTITUTE

In contrast to sodium, potassium intake is rather low in developed countries, and evidence has accumulated that increasing potassium intake may help in preventing the development of hypertension, lowering BP and reducing stroke incidence in hypertension [6]. The use of low-sodium salt substitute, in which sodium is in part replaced by potassium chloride (KCl), has recently been shown to induce significant decreases in systolic and diastolic BP in hypertensive patients as well as in normotensive subjects without significant adverse effects [7]. However, because of the studies heterogeneity, there was no effect of increasing potassium intake on overall mortality and intermediate outcomes in this analysis. These data are supported by the recent results of a prospective, randomized, population-wide study on salt substitution conducted in six Peruvian villages [8]. In this study, investigators retrieved the regular household salt and replaced it with a combination of 75% NaCl and 25% KCl. Thereafter, all subjects were followed for several months. The substitution was associated with modest but significant decreases in BP. However, the most interesting observation was a 51% (95% CI 29–66) reduced risk of developing hypertension in non-hypertensive subjects when compared with the control group, supporting the preventive effect of increasing potassium intake.

In conclusion, recent publications support the general recommendation to lower salt intake as a strategy to prevent the development of hypertension and to lower BP in all hypertensive patients. In patients with hypertension and chronic kidney disease, a reduction of sodium intake potentiates the efficacy of antihypertensive drugs and lowers proteinuria, but the impact of low sodium intake on renal disease progression remains controversial because of inconsistent findings from cohort studies [9] and the lack of randomized prospective studies.

CONFLICT OF INTEREST STATEMENT

None declared.

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