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Baking Soda May Slow Progression of Chronic Kidney Disease



Deborah Brauser

July 16, 2009 — Daily supplementation with sodium bicarbonate slows the progression rate of renal failure to end-stage renal disease (ESRD) and improves nutritional status among patients with chronic kidney disease (CKD), according to a randomized, open-label study reported online July 16 in the *Journal of the American Society of Nephrology*.

"Metabolic acidosis..., generally perceived by clinicians as a low plasma bicarbonate, is a common complication in patients with [CKD], particularly when [glomerular filtration rate] falls below 30 ml/min," write Ione de Brito-Ashurst, from the Department of Renal Medicine and Transplantation at the William Harvey Research Institute, and Barts and the London National Health Service Trust, United Kingdom, and colleagues. "This, in turn, may bring about a variety of sequelae, such as stunted growth in children, loss of bone and muscle mass, negative nitrogen balance, and possible acceleration of progression of CKD."

Past studies have shown that bicarbonate supplementation preserves renal function in experimental CKD, but whether the same benefit occurs in humans is unknown, the authors write. "The lack of long-term studies examining the impact of alleviation of metabolic acidosis on renal function in predialysis patients and on nutritional status was the particular stimulus to perform this study."

The primary endpoints were rate of creatinine clearance (CrCl) decline and the proportion of patients with rapid decline of CrCl (>3 mL/minute/1.73 m²/year) and ESRD (CrCl < 10 mL/minute). Secondary endpoints were dietary protein intake, normalized protein nitrogen appearance, serum albumin, and midarm muscle circumference.

The investigators enrolled 134 adult patients with CKD (CrCl 15 – 30 mL/minute/1.73 m²) and serum bicarbonate levels of 16 to 20 μ mol/L. All patients were randomly assigned to receive either 600 mg oral sodium bicarbonate tablets at 1.82 ± 0.08 g/day (n = 67; mean age, 54.78 ± 2.56 years; 52% men; 52% white) or standard treatment (n = 67; mean age, 54.77 ± 2.56 years; 51% men; 52% white) during a 2-year period.

All patients performed 24-hour urine collections at the study's start and then every 2 months, which the investigators used to measure serum HCO₃⁻, potassium, creatinine, urea, albumin, and C-reactive protein. At each follow-up visit, blood pressure, drug compliance by direct questioning, body weight, and midarm circumference were documented. The phosphoenolpyruvate method was used for measuring bicarbonate levels. An estimate of the habitual dietary intake of each patient was made from a 4-day food diary completed before each follow-up appointment.

At the end of the study, the rate of decline in CrCl was significantly slower for those treated with the bicarbonate supplementation compared with the control group (5.93 vs 1.88 mL/minute/1.73 m²; $P < .0001$).

In addition, rapid progression occurred in just 9% of the patients receiving bicarbonate supplementation vs 45% of those receiving standard care (relative risk [RR], 0.15; 95% confidence interval [CI], 0.06 – 0.40; $P < .0001$).

Four patients in the bicarbonate group developed ESRD requiring dialysis (6.5%) compared with 22 patients in the control group (33%; RR, 0.13; 95% CI, 0.04 – 0.40; $P < .001$).

Several nutritional parameters also improved significantly with bicarbonate supplementation. Dietary protein intake

showed a significant increment compared with that in the control group ($P < .007$), whereas normalized protein nitrogen appearance decreased ($P < .002$). This increase in dietary protein intake and reduction in normalized protein nitrogen appearance led to an increment in the lean body mass as assessed by midarm muscle circumference in the treatment group from 24.8 (23.7 – 25.8) to 26.3 (25.0 – 27.5) compared with no change in the control group ($P < .03$).

In addition, serum albumin levels rose in the treatment group but remained unchanged in the control group, and serum potassium levels declined ($P < .05$).

Although sodium intake did increase for the sodium bicarbonate group vs the control group, it did not lead to increased blood pressure.

"This is the first randomized, controlled clinical study in which oral sodium bicarbonate supplementation was associated with positive results in both primary and secondary endpoints in patients with CKD," the study authors write. In addition, "there was no effect on [blood pressure] or evidence of worsening edema as assessed clinically at every clinic consultation."

Limitations of the study include the absence of a double-blind design — the researchers were aware of which patients were receiving the supplement — and the lack of placebo.

"Oral sodium bicarbonate supplementation in patients with low plasma HCO_3^- levels slows the rate of decline of renal function and the development of ESRD in patients with advanced stages of CKD," the study authors conclude. "This cheap and simple strategy...improves the nutritional status of patients and has the potential of translating into significant economic, quality-of-life, and clinical outcome benefits."

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Authors and Disclosures

Journalist

Deborah Brauser

is a freelance writer for Medscape.

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