



EFFECT OF ORAL SODIUM BICARBONATE ON PHYSICAL FUNCTION IN PATIENTS WITH CHRONIC KIDNEY DISEASE

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Introduction: The kidneys regulate the systemic serum bicarbonate (HCO_3^-) concentration and therefore the metabolic component of acid-base balance. Kidneys make new HCO_3^- by excreting acid in the form of titratable acid and ammonium (NH_4^+). In patients with Chronic Kidney Disease (CKD), urinary NH_4^+ excretion declines and over time there is acid accumulation leading to low HCO_3^- levels and low blood pH, known as metabolic acidosis. Previous studies have shown that metabolic acidosis causes skeletal muscle catabolism. Metabolic acidosis is commonly treated with sodium bicarbonate (NaHCO_3) to preserve muscle strength and physical function. The effect of oral NaHCO_3 in patients with CKD and without metabolic acidosis is uncertain. It was hypothesized that oral NaHCO_3 improves physical function in patients with CKD.

Methods: We conducted a single-center, randomized, double-blinded, placebo-controlled study of 74 US veterans with CKD, diabetes, and normal serum HCO_3^- concentration. Participants were randomized to take oral NaHCO_3 (0.5 meq/kg-LBW/d) or placebo for 6 months. The primary objective of the study was to determine the effect of NaHCO_3 on kidney injury parameters. The objective of this secondary analysis was to determine the effect of sodium bicarbonate over 6 months on physical function as assessed by Short Physical Performance Battery (SPPB), SF-36, shuttle walk, sit-to-stand time, and 4-meter walk.

Results: There was a statistically significant improvement in the 4-meter walking speed ($p < 0.01$) over the 6-month period. As shown in **Table 1**, time for completing the activity decreased indicating a faster walking time. In addition, the shuttle number for the treatment group increased significantly ($p = 0.04$), meaning that patients were able to complete more shuttle walks within a given time frame. NaHCO_3 modestly improved SPPB score ($p = 0.1$) but did not affect sit-to-stand time ($p = 0.5$) or perceptions of general health ($p = 0.7$), as assessed by the SF-36.

| Test | Treatment | Baseline | 3-months | 6-months |
|-------------------------|------------------|-----------------------|-----------------------|-----------------------|
| SPPB (score) | Placebo | 8.5 (2.6) (n=28) | 8.8 (2.6) (n=19) | 8.2 (2.9) (n=18) |
| | NaHCO_3 | 8.9 (2.7) (n=28) | 9.2 (2.8) (n=20) | 9.8 (2.9) (n=17) |
| SF-36 (score) | Placebo | 53.7 (20.1) (n=35) | 53.7 (19.0) (n=30) | 53.2 (16.1) (n=30) |
| | NaHCO_3 | 50 (18.9) (n=33) | 51.2 (19.8) (n=29) | 51.5 (19.0) (n=29) |
| 4 m walk (sec) | Placebo | 4.6 (1.1) (n=28) | 4.7 (0.9) (n=19) | 4.6 (1.0) (n=17) |
| | NaHCO_3 | 4.6 (1.6) (n=28) | 4.3 (1.4) (n=20) | 3.7 (0.6) (n=15) |
| Shuttle Number (number) | Placebo | 12.7 (6.0) (n=23) | 12.6 (7.9) (n=17) | 11.6 (6.3) (n=14) |
| | NaHCO_3 | 13.7 (7.0) (n=25) | 14.4 (7.3) (n=19) | 16.6 (5.8) (n=14) |
| Sit-to-stand time (sec) | Placebo | 12.6 (4.0) (n=22) | 13.7 (4.1) (n=17) | 14.1 (4.5) (n=15) |
| | NaHCO_3 | 13.3 (3.5) (n=21) | 15.2 (4.7) (n=16) | 13.3 (2.7) (n=17) |

Table 1. Mean (SD) and number who completed the tests at each visit.

Conclusions: During the course of the study, patients who were treated with NaHCO_3 had improvements in walking parameters as assessed by 4-meter walking time and performance on the shuttle walk test. NaHCO_3 did not have significant effects in the other tests. However, with the results thus far with increased physical performance in some areas, there is potential to see additional positive correlations with this treatment and enhanced physical abilities. Some limitations of this study are the small sample size and many patients were unable to complete the activity tests due to feeling unsafe or other reasons. Also, most participants were white and male, therefore not representative of the population as a whole. Further studies with larger sample sizes testing the effect of NaHCO_3 on physical function in patients with CKD and normal serum HCO_3^- are warranted.