

Bicarbonate treatment restores renal Klotho production: a pilot study



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OBJECTIVES

Metabolic acidosis is commonly observed in chronic kidney disease (CKD) and a positive relationship exists between serum bicarbonate (sbicar) and α -Klotho in CKD patients. We tested the hypothesis that correcting acidosis may improve renal Klotho production and serum α -Klotho.

METHODS

The study involved 20 patients with a known kidney disease referred for renal check-up. Inclusion criteria were age ≥ 18 yr, CKD stage 3-5ND, sbicar < 22 mmol/l, not receiving bicarbonate supplementation. Patients then received 1g oral sodium bicarbonate 3x/d for 4 weeks and were evaluated at two and four weeks by blood and urine measurements.

RESULTS

Variable	Value
Age (yr)	68 (58.5-77.8)
Gender (% women)	57.1
Body mass index (kg/m ²)	26.3 \pm 4.7
α -Klotho (pg/mL)	614.6 \pm 287.2
FGF 23 (RU/mL)	469.9 \pm 628.1
25-OH Vitamin D (nmol/L)	51.0 \pm 24.9
intact parathyroid hormone (pg/mL)	92.6 \pm 97.4
C Reactive Protein (mg/L)	6.0 \pm 5.7
Albumin (g/L)	38.8 \pm 3.7
Bicarbonate (mmol/L)	19.3 \pm 1.7
Calcium (mmol/L)	2.3 \pm 0.1
Phosphorus (mmol/L)	1.2 \pm 0.4
Creatinine (μ mol/L)	213.4 \pm 161.7
eGFR (CKD-EPI, mL/min/1.73m ²)	31.5 \pm 14.0
Hemoglobin (g/L)	116.6 \pm 18.3
Proteinuria (g/d)	1.2 \pm 1.4
Urine pH	6.4 \pm 0.8
Diuresis (mL/24h)	1417 \pm 784
Urine Klotho/Creatinine	34.6 \pm 31.6

Table 1. Patients characteristics and serum values at baseline

Mean \pm SD	Baseline	Wk 2	p	Wk 4	p
Klotho (pg/mL)	614.6 \pm 287.2	630.2 \pm 333.5	0.35	632.1 \pm 284.9	0.78
Bicarbonates (mmol/L)	19.3 \pm 1.7	23.9 \pm 2.9	< 0.001	23.4 \pm 1.9	< 0.001

Table 2: Serum values before, two and four weeks after bicarbonate supplementation (n=20, ANOVA test from baseline values)

DISCUSSION

We found for the first time that correcting **acidosis** is associated with higher urine/creatinine ratio of α -Klotho at week 2 and 4 after oral alkaline therapy. We can speculate that the **tubular** function changes that occur in response to metabolic acidosis may be implicated in the altered expression of **serum** and **urine** α -klotho at this secretory site. Correcting acidosis may restore α -klotho synthesis or its cleavage process first in the urine then in serum.

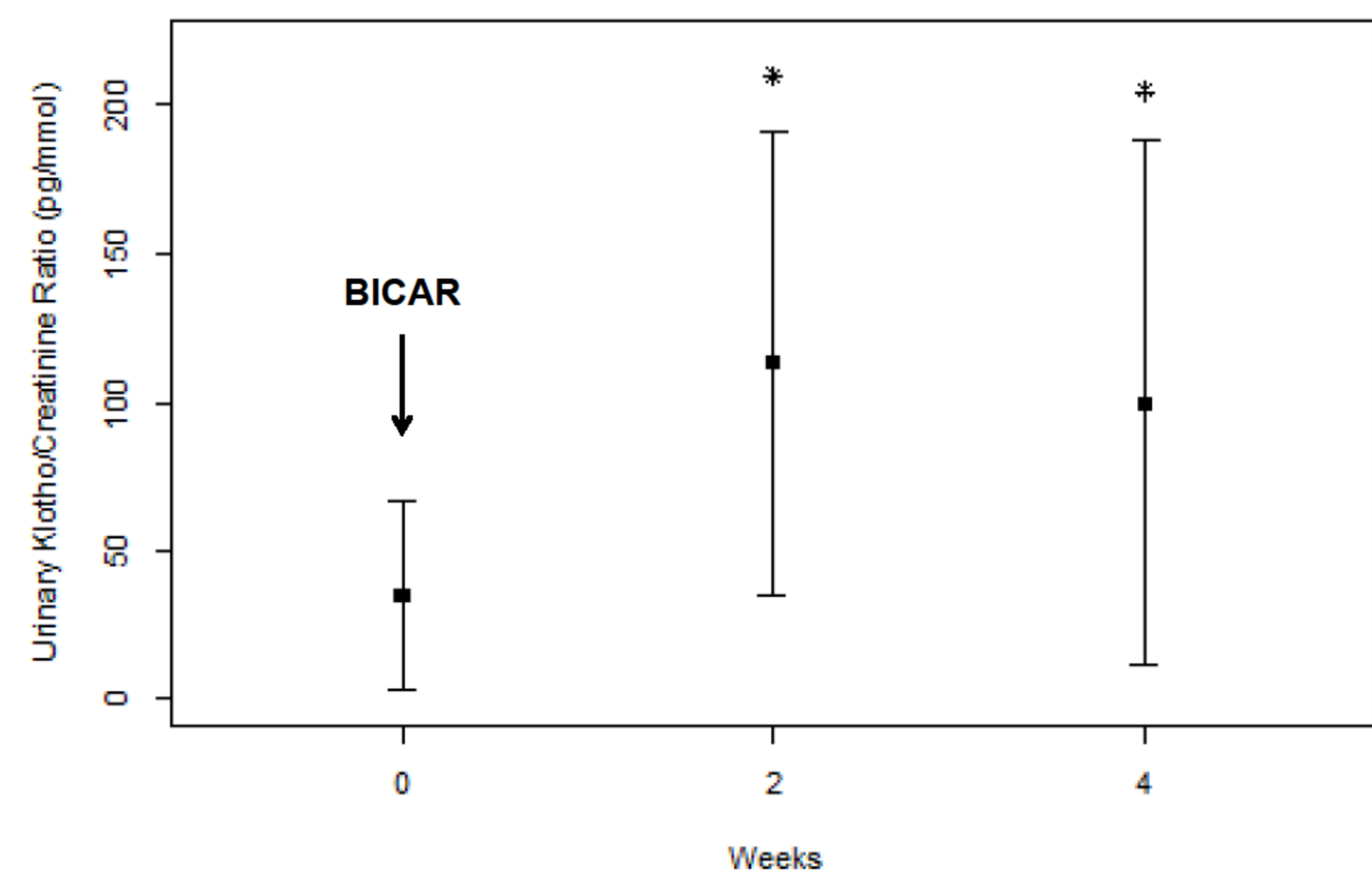


Figure 1. Variations of urinary Klotho/creatinine ratio during bicarbonate treatment (mean \pm SD, n=20; * indicates $p < 0.05$).

CONCLUSIONS

Correcting **acidosis** by oral administration of sodium bicarbonate rapidly restores the reduced tubular synthesis of soluble **α -Klotho** in CKD patients. However, a four-week bicarbonate treatment was not able to significantly increase serum α -Klotho. A longer study with more patients may confirm this interesting modification.

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