

Lowering Dietary Phosphate Intake Reduces Fibroblast Growth Factor 23 (FGF-23) in Chronic Kidney Disease Stages 3 and 4

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BACKGROUND: FGF-23 is thought to play a critical role in the hormonal regulation of urinary phosphate. In the later stages of CKD both phosphate and FGF-23 are highly deranged and associated with both vascular calcification and mortality. This study describes the physiological response of altered dietary phosphate on circulating FGF-23 and associated biochemical parameters of mineral metabolism in early stages of CKD.

METHODS: 20 stage 3 and 4 CKD Subjects and 12 healthy controls with serum phosphate in the normal range were included in this study. Subjects followed 7-days of the following three diets; high phosphate (HP) (2500mg), low phosphate (LP) (750mg) and low phosphate plus an aluminum based phosphate binder (LP+B). Dietary compliance was encouraged with the provision of a daily eating plan including specified quantities and portion sizes and a grocery basket of appropriate foods. Fasting serum Calcium, phosphate (PO₄), intact PTH, intact FGF-23, 1,25 and 25 vitamin D and 24hr urinary excretion of Calcium and PO₄ were assessed at the end of each week. FGF-23 was assessed using the Kainos assay.

RESULTS: Baseline FGF-23 was 100pg/ml in the CKD group and 32 pg/ml in the control group (P<0.0001). Baseline phosphate was 3.3±0.5 mg/dl in the CKD group and 3.4±0.5 mg/dl in the control group (NS). In CKD FGF-23 was significantly higher with a HP diet (121± 7pg/ml) than with a LP+B diet (82±60 pg/ml) (P<0.01). Concurrently there were significant falls in urinary PO₄, PTH & 25 Vit D on the LP+B diet, although 1,25 vit D rose while PO₄ stayed relatively stable. Results followed similar trends in the control group. FGF-23 significantly correlated with eGFR (r=-0.78, P<0.0001), intact PTH (r=0.51, P=0.002) and 1,25(OH)D (r=-0.68, P<0.0001).

CONCLUSIONS: Reductions in dietary phosphate result in reductions in FGF-23, even when serum phosphate levels are normal. These results demonstrate that a phosphate lowering diet could be beneficial for CKD patients well before their serum phosphate starts to rise late in the progression of CKD.