

Effects of kidney disease and dietary inulin treatment on transcellular phosphorus transporters

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Intro

Chronic Kidney Disease – mineral bone disorder (CKD-MBD) is marked by biochemical abnormalities, bone alterations, and vascular calcifications. We recently showed that the fermentable fiber inulin lowered circulating phosphorus. Our objective was to determine the effect of dietary inulin on the expression of intestinal phosphate transporters.

Methods

Starting at 22 weeks of age (~ 50% normal GFR) and for 8-or-10 weeks, normal littermates (NL) and Cy/+ male rats (CKD) were fed a 0.7% phosphorus, casein-based diet without or with 10%-inulin (**CKD+IN**); At euthanasia (30 or 32 weeks, ~30-to-15% normal GFR), mucosa from duodenum, jejunum, and ileum was collected for intestinal transporter expression (NaPi2b, PiT1, PiT2, NHE3) via qPCR. Data was analyzed via 2-way ANOVA.

Results

CKD animals developed hyperphosphatemia at 32 weeks, but CKD+IN lowered circulating phosphorus. NaPi2b was expressed highest in the jejunum, followed by the duodenum, but not ileum. At 32 weeks, NaPi2b was lower in CKD and CKD+IN in the duodenum and jejunum compared to NL ($p<0.05$). PiT1 was expressed in all three intestinal segments. Duodenal PiT1 expression was increased in the CKD group compared to NL and CKD+IN ($p<0.05$), but the expression was unchanged in the jejunum or ileum. PiT2 expression was consistent across all three segments. Duodenal PiT2 expression decreased in CKD and CKD+IN compared to NL ($p<0.05$). NHE3 expression were highest in jejunum. From 30-to-32 weeks, NL had increased duodenal NHE3 expression ($p<0.05$), but expression was similar between CKD and CKD+IN in jejunum and ileum.

Conclusions

CKD alters intestinal phosphate transporters, but a 10% Inulin diet did not affect their expression in the small intestine. Lowering circulating phosphorus may be related to improvements in gastrointestinal microbiota, reduction of uremic toxins, and possibly phosphorus transport in the cecum and colon. Furthermore, the effect of inulin on paracellular phosphate absorption in CKD should be explored.