28) Renal Adaptation to a Low Phosphate Diet in Spontaneously Hypertensive Rats. Kiyoshi Hirano, Masaki Nagasawa, Kazuhiro Saito, and Hikaru Koide. Division of Nephrology, Department of Medicine, Juntendo University School of Medicine, Tokyo

The major renal adaptive changes in response to selective dietary phosphate restriction are a marked reduction in urinary excretion of phosphate and an increased urinary excretion of calcium, at the cellular level, there is selective increase of phosphate uptake in renal cortical brush border membrane and an increase in specific activity of alkaline phosphatase.

In the present study we examined the renal adaptation to low phosphate diet (LPD) in spontaneously hypertensive rat (SHR) and in normotensive Wistar-Kyoto rat (WKY) kept for 6 days on LPD (0.17% of dry matter) or a normal phosphate diet (NPD, 0.52% of dry matter). Renal brush border membrane vesicles (BBMV) were prepared from superficial cortex and deep cortex of each groups using Mg precipitation method and controlled pore glass column chromatography. The uptake of labeled substrate by BBMV was measured in triplicate by a rapid-filtration technique. Apparent K_m and V values were calculated from regression lines obtained from Eadie-Hofstee plots.

There was a positive correlation between phosphate depletion and the activity alkaline phosphatase which was measured in the vesicle preparations from each group of rats. There was no correlation between phosphate depletion and the activities of two other brush border enzymes. Serum phosphate was significantly decreased from 7.07 to 4.85 mg/dl in SHR, and from 7.53 to 5.56 mg/dl in WKY feeding of LPD. Fractional excretion of phosphate (FE_{Pi}) was also significantly decreased from 13.1 to 0.27% in SHR, and from 9.95 to 0.03% in WKY, but a degree of the decrement was lower in SHR than in WKY. Creatinine clearance was not significant among each groups of rats.

In LPD and NPD feeding phosphate uptake by BBMV prepared from the superficial cortex of SHR showed no difference. However, phosphate uptake by BBMV prepared from the deep cortex was increased from 3.70 to 5.90 n mole/mg protein/20s in LPD feeding. On the other hand, phosphate uptake by BBMV prepared from WKY were increased from 6.00 to 8.56 n mole/mg protein/20s in superficial cortex, and from 2.48 to 4.57 n mole/mg protein/20s in deep cortex in LPD feeding.

The table shows the results of kinetic study of phosphate uptake by BBMV. The V values were not significantly different from LPD and NPD feeding in superficial cortex of SHR and increased from 3.86 to 6.14 n mole/mg protein/20s in deep cortex of SHR in LPD feeding. Meanwhile, in WKY the V value increased in both superficial cortex (from 5.23 to 10.9 n mole/mg protein/20s) and deep cortex (from 2.69 to 4.3 n mole/mg protein/20s) in LPD feeding. The apparent K_m were not different from LPD and NPD feeding. There was a positive correlation between V values and phosphate uptake, and was no correlation between apparent K_m and phosphate uptake in all groups.

These results suggest that renal adaptation to LPD in SHR did not occur in superficial cortex, so that the FE_{Pi} of SHR is higher than that of WKY.

	Superficial Cortex		Deep Cortex	
SHR	Vmax	Km	Vmax	Km
LPD	4.52 ± 0.24	47 ± 2.0	6.14 ± 0.21	23 ± 4.8
NPD	4.53 ± 0.35	51 ± 4.8	3.86 ± 0.01	24 ± 0.3
	N.S.		< 0.01	
WKY				
LPD	10.9 ± 0.20	49 ± 3.0	4.30 ± 0.62	24 ± 2.6
NPD	5.23 ± 1.18	37 ± 0.9	2.69 ± 0.06	36 ± 9.4
	< 0.05		N.S.	
	mean ± S.E.			