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Dietary Regulation of Taurine Transport across the Renal Proximal Tubule Brush Border Membrane in Cats.

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Taurine (2-aminoethanesulfonic acid) is a conditionally essential amino acid in preterm and full-term neonates because of their limited ability to synthesize taurine from other sulfur amino acids. Kidney plays an important role in maintaining body taurine homeostasis via an active taurine transport mechanism located in the proximal tubule brush border membranes. The taurine transport system is dependent on the external Na^+ and Cl^- gradients, and has a specificity for β-amino acids, such as β-alanine, hypotaurine and GABA. The purpose of the present study was to evaluate the renal adaptation of cats, a species having limited ability to biosynthesize taurine, to altered dietary taurine intake using isolated proximal tubule brush border membrane vesicles (BBMV). Three groups of cats were adapted to purified diets containing 43.5% soy protein plus: taurine-free (0T); 0.15% taurine (NT); or 1.0% taurine (HT). The plasma taurine concentrations of the cats fed the 0T decreased from 104 ± 25 μM to 16 ± 5 μM and 1.7 ± 0.5 μM in 1 week and 6 weeks, respectively. HT increased plasma taurine concentrarion to 350 ± 116 μM in 1 week. Compared to NT, taurine accumulation by BBMV was significantly elevated after 4 weeks of feeding 0T and decreased after 2 weeks or less of feeding HT ($p<0.05$). Maximum renal adaptation occurred by 6 weeks of feeding (206% increase in taurine uptake/15 sec. compared to NT) and by 2 weeks or less of feeding HT (43% decrease in taurine uptake/15 sec. compared to NT). Evaluation of transport kinetics using renal cortex from groups of 4 cats (16 determinations) fed NT, 0T (12 weeks) or HT (10 weeks) revealed a V_{max} of 55 ± 10, 123 ± 24, or 39 ± 7 pmoles·mg protein^{-1}·10 sec^{-1} and Km of 32 ± 7, 16 ± 2, or 37 ± 8 μM, respectively. The differences in V_{max} and K_m were significant between NT and 0T ($p<0.05$), but not significant between NT and HT ($p<0.05$). Our results suggest that adaptation of the cat to changes in dietary taurine intake occurs with modifications both V_{max} and K_m of the renal taurine transport system.