Thesis Title The Relative Significance of Various Intestinal Segments in Plasma Calcium Regulation

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ABSTRACT

Despite a number of studies on transepithelial calcium transports by the various intestinal segments, there has been no report on the relative significance of these different segments of equal length in terms of calcium absorptive and secretory capacities under the same calcium load.

In this study, test solutions containing varying concentration of $CaCl_2$ labeled with ^{45}Ca were instilled into 6 different intestinal loops of 5 cm length, one loop per rat. The amounts of calcium absorbed expressed as net amount or % administered dose were calculated from plasma ^{45}Ca content at various time intervals.

The amount of calcium absorbed increased with increasing luminal calcium concentration. However, the efficiency of calcium absorption decreased as the luminal calcium concentration increased. At the luminal calcium concentration of 0.3 mM, the relative capacities of the various intestinal segments to absorb calcium were : duodenum = colon > proximal jejunum = jejunum > ileum = cecum. At higher luminal calcium concentration of 10 mM, the order of absorptive capacity was : duodenum = proximal jejunum > jejunum = colon > ileum = cecum. Under normocalcemic condition, the proximal small intestine showed higher secretory ability than the distal part with the order of secretory ability being; duodenum > jejunum = proximal jejunum > ileum = cecum = colon.

Possible role of various intestinal segments in acute plasma calcium regulation was investigated under hypercalcemic and hypocalcemic conditions. During acute hypercalcemia induced by $CaCl_2$ infusion, calcium secretion was markedly increased in all segments except the cecum whereas calcium absorption was significantly reduced. The data, thus, showed that the intestine appeared to help buffering the plasma calcium concentration during hypercalcemic condition. On the other hand, during the TPTX-induced hypocalcemia, both intestinal calcium absorption and secretion significantly decreased in most intestinal segments especially the duodenum and colon. This reduction in calcium absorption probably resulted from an absence of parathyroid hormone which normally

enhanced intestinal calcium absorption via stimulating $1,25\ (OH)_2D_3$ production. In EGTA-induced hypocalcemia, the calcium absorption was also reduced indicating that calcium absorption may be affected by a reduction in the plasma ionized calcium concentration. In contrast to hypercalcemia, the intestinal handling of calcium did not contribute to the plasma calcium regulation.