Role of peptide tyrosine tyrosine (PYY) in the regulation of gastrointestinal motility and pancreatic exocrine secretion in sheep

ONAGA, Takenori

Japanese Journal of Veterinary Research, 49(1): 30-31

2001-05-31

http://hdl.handle.net/2115/2866

bulletin

KJ00002400328.pdf

Hokkaido University Collection of Scholarly and Academic Papers : HUSCAP
Role of peptide tyrosine tyrosine (PYY) in the regulation of gastrointestinal motility and pancreatic exocrine secretion in sheep.

Takenori Onaga

Laboratory of Veterinary Physiology, Department of Veterinary Medicine, School of Veterinary Medicine, Rakuno Gakuen University, Ebetsu, Hokkaido 069-8501, Japan

The present study was performed to evaluate physiological roles of PYY in the regulatory mechanisms in the ovine alimentary tract. Immunohistochemistry revealed that PYY localized only in mucosal endocrine cells in the ileum and large intestine in sheep. In HPLC analysis, identical PYY-immunoreactivity with pure porcine PYY was detected from the mucosa of the ovine large intestine. Specific radioimmunoassay using scraped intestinal mucosa revealed that tissue contents of PYY in mucosa are higher in the colon and rectum in the ovine intestine, whereas they are approximately ten-times smaller than that in the rat intestine. Plasma concentration of PYY before feeding in sheep was as low as that in interdigestive period in rats and humans, however, it was hardly altered over 48 hours in sheep, even after feeding with lucerne pellets and hay or concentrate. Intravenous infusion of porcine PYY during phase II at a dose, which produces twice higher levels of postprandial plasma concentration of PYY in dogs, shortened duodenal MMC cycle in sheep with delay after the end of infusion. However, it did not alter regular ruminal contractions and pancreatic exocrine secretion. Likewise, intravenous bolus injection of PYY at the supraphysiological range of doses scarcely altered ruminal contractions and pancreatic exocrine secretion at even supraphysiological doses.

In conclusion, PYY is localized in the mucosa of the lower intestine, whereas it is barely released into blood by ingestion of feed, the luminal nutrients and circulating CCK in mature sheep. Therefore, endogenous PYY in the lower intestine is not probably involved in feedback regulatory mechanisms in the ovine digestive tract. Humoral kinetics and physiological role of PYY in the ovine digestive tract definitely differ from those evaluated in
Adenosine-5'-triphosphate (ATP) coexists with catecholamine (CA) in the secretory vesicles of sympathetic nerve terminals and adrenal chromaffin cells. We developed an on-line system for continuous measurement of CA and ATP released from cultured porcine adrenal chromaffin cells and PC12 cells.

CA and ATP were continuously measured with an electrochemical detector and ATP photometer with luciferin-luciferase, respectively. Acetylcholine (ACh, 0.1 mM) or high K⁺ (60 mM) was applied to perfused porcine adrenal chromaffin cells and CA and adenine nucleotides in the collected effluent were analysed with HPLC. The most of CA in the effluent was noradrenalin (81%) and the other was adrenaline (19%). The relative amounts of ATP, ADP and AMP in the effluent were 1, 1.3 and 1, respectively. These ratios were almost the same throughout the period of stimulation.

Using the on-line system, CA and ATP released from cultured porcine adrenal chromaffin cells in response to ACh (0.1 mM) or high K⁺ (60 mM) were measured. Increases of CA and ATP in perfused effluent were transient in nature regardless of continuous presence of the secretogogues and their time courses were almost coincident. The molar ratios of CA to ATP (CA/ATP) in the effluent was 10 ± 1 and 12 ± 1 with ACh and high K⁺ stimulation, respectively. In response to repetitive high K⁺ stimulation (60 mM), CA and ATP were also released into perfused effluent with the same time courses. Although the amounts of released CA and ATP decreased with repetition, their time courses appearing in the effluent were almost same and the CA/ATP was 12 ± 2. Ba²⁺ (5 mM) produced rapid increases in CA and ATP, and then the secretory responses declined to about 50% of the peak and sustained during the presence of Ba²⁺. Even in this case, the time courses of CA and ATP appearing in the effluent were also almost same and the CA/ATP was 12 ± 2.

The HPLC analysis of CA revealed that the most CA released from pheochromocytoma (PC12) cells in response to stimulus was dopamine (90%). On-line measurement revealed that high K⁺ (60 mM), ACh (0.1 mM) and Ba²⁺ (5 mM) caused dopamine and ATP release with almost same time courses. These secretory responses of dopamine and ATP were quite similar to those of cultured non-ruminant species.