Abstract

Epithelial ion transport is dependent on ATP supply provided by aerobic metabolism. In the rat distal colon chloride secretion accounts for the largest portion of electrogenic transport measured as the short-circuit current (ISC). Inhibition of basal chloride secretion decreases epithelial oxygen consumption (QO2) in this tissue, while serotonin (5-hydroxytryptamine) proportionally increases both ISC and QO2. The effect of serotonin in this tissue is mainly mediated by 5HT4 receptors linked to adenylate cyclase through a stimulant G protein (GS). This work assessed whether the chloride secretion-induced increase in QO2 is a common characteristic of secretagogues, which act through either cAMP-dependent or Ca2+-dependent mechanisms. The effects of phosphodiesterase inhibitor 3-isobutyl-1-methylxantine (IBMX) and muscarinic agonist carbachol (both 0.1 mmol/L) were studied in rat distal colon isolated mucosa mounted in an Ussing chamber adapted for continuous measurement of oxygen concentration, allowing determination of QO2. Baseline ISC and QO2 were compared with ISC and QO2 after addition of either serotonin as an active control, IBMX, carbachol or IBMX plus carbachol. Each drug increased proportionally ISC and QO2. Although the effect of IBMX alone was modest and that of carbachol was short-lived, a synergic effect on ISC and QO2 was seen when both drugs were simultaneously added. Linear regression analysis showed a significant correlation between increases in ISC and QO2 ($r^2 = 0.746; P < 0.0001$). Thus, stimulation of chloride secretion increases QO2 regardless of the intracellular pathway involved. These results extend previous findings, corroborating the close coupling between chloride secretion and QO2 in this epithelium.

Keywords
chloride secretion, oxygen consumption, descending colon