EFFECTS OF PH, AMILORIDE AND BUMETANIDE ON INTESTINAL SODIUM AND CHLORIDE TRANSPORT IN THE WINTER FLOUNDER (PSEUDOPLEURONECTES AMERICANUS)

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In previous studies of the winter flounder small intestine, we found that decreasing pH below 7.8 (normal blood pH), markedly reduced active chloride absorption. This was caused by an increase in the serosa to mucosa flux of chloride (Jsm). This effect of pH is remarkable because a chloride secretory process has not been described in the flounder intestine and because in mammalian intestine reductions in pH stimulate chloride (and sodium) absorption. To determine whether sodium absorption was affected in a similar way, and to further characterize the transcellular sodium and chloride transport pathways, we measured sodium and chloride flux simultaneously under a variety of acid-base conditions.

Small intestinal segments of the winter flounder were removed, stripped of serosa and studied under short circuit conditions in the Ussing chamber. Bathing solution pH was varied between 7.8 and 7.1 by changing the bicarbonate concentration (5, 11, or 20mM) and PCO2 (7 or 35mmHg) of the teleost Ringers solution. We found that regardless of the prevailing bicarbonate concentration and PCO2, both sodium and chloride absorption were decreased as pH was reduced. However, whereas JClnet was reduced because of a rise in JClsm, JNanet was reduced because of a decrease in JNams. These effects were reversible and were inhibited by 1.0 mM mucosal bumetanide. We also found that the mucosal addition of 1.0 mM amiloride had an inhibitory effect on both sodium and chloride absorption.

		JNams	JNanet	JClsm	JClnet
Controls	pH 7.1	9.3±0.9	1.4±1.2	5.5±0.8	0.5±0.8
	pH 7.6	10.9±0.9	3.2±1.0	3.7±0.8	1.8±1.4
	pH 7.8	10.8±0.8	3.3±1.2	2.7±0.7	3.4±1.3
Amiloride	pH 7.8	5.9±1.0	1.2±0.4	3.3±1.3	0.6±1.4
Bumetanide	pH 7.8	7.9±0.1	0.9±1.0	4.0±1.9	1.3±2.2
Amil+Bumet	pH 7.8	5.8±0.6	0.9±0.6	3.8±0.7	1.9±1.3

(Results expressed as means±SE in uEq/cm2.hr)

These results suggest that pH alters sodium and chloride absorption in the flounder small intestine by more than one mechanism. That is, inhibition of the putative luminal membrane Na,K,2Cl absorptive process does not account for the effects of reductions in pH. A luminal membrane Na/H ion exchange process also may participate in intestinal sodium absorption in the flounder.

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