

Promotion of Intestinal Motility by TRPA1 Activation through Salt Intake.

Koji Shibasaki

Laboratory of Neurochemistry, Department of Nutrition Science, University of Nagasaki

Summary

Serotonin (5-hydroxytryptamine; 5-HT) is abundantly present throughout the gastrointestinal tract and stored mostly in enterochromaffin (EC) cells, which are existed in the mucosal surface. 5-HT released from EC cells stimulate intrinsic and extrinsic nerves, and caused gastrointestinal contractions. EC cells are believed to have the ability to respond to the chemical composition of the luminal contents of the gut; however, the underlying molecular and cellular mechanisms have not been well identified. It was reported that the transient receptor potential (TRP) cation channel TRPA1 is highly expressed in EC cells. TRPA1 agonists, such as allyl isothiocyanate and cinnamaldehyde, stimulate EC cell functions, such as increasing intracellular Ca^{2+} levels and 5-HT release. It has been reported that TRPA1 is activated by various stimuli such as cold ($<17^{\circ}\text{C}$), Allyl isothiocyanate (AITC in Wasabi and mustard oil), extracellular alkaline condition and mechanical stimulus. All TRP channels have unique properties called as synergistic effects. If we apply two different agonists, thresholds of each agonist can be effectively reduced. Thus, we can observe significant TRP channel activation by combination of two different agonists. These backgrounds indicate that TRPA1 can be potentiated by weak alkaline condition. In this study, we examined the possibility by physiological experiments. We prepared cultured EC cells from mouse small intestine, and examined the effects of extracellular high Na^{+} and Ca^{2+} conditions on TRPA1 activation by AITC. AITC-activated TRPA1 currents were significantly potentiated in the high Na^{+} and Ca^{2+} condition compared with those in normal salt condition. These results indicate that high Na^{+} and Ca^{2+} condition significantly enhances the TRPA1 property for AITC responses. We expected that these properties promotes intestinal motility.