

Role of Tight Junction in Intestinal Na Homeostasis and Nutrient Absorption

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Summary

Paracellular pathway in the intestinal epithelia is permeable to Na⁺ and K⁺, and claudin-15, a protein present at tight junction, is probably mainly responsible for this property. This study investigated a physiological role of the paracellular cation-permeability in intestinal carbohydrate assimilation, by using claudin-15 deficient (KO) mice. It is known that KO mice exhibit phenotypic megaintestine. The wild-type (W) and KO mice were fed with the food containing 60% starch as a carbohydrate and 1.6% polyethylene-glycol 4000 (PEG) as a nonabsorbable marker. After 3 h of feeding, intestinal content was collected and analysed. Carbohydrate assimilation as a whole is not reduced in the KO mice. However, while carbohydrate assimilation was mostly completed in the proximal part of small intestine in the W mice, it occurred along the entire small intestine in the KO mice. In addition, when the rate of assimilation of starch in the proximal small intestine was estimated from the decrease of luminal starch/PEG ratio, it was lower in the KO mice than in the wild-type mice. The sodium concentration in the lumen of the small intestine was ~60 mM in the W mice, while it was reduced to less than 20 mM in the KO mice. In conclusion, while the efficiency of carbohydrate assimilation per intestinal area was reduced in the KO mice probably due to decreased luminal Na concentration, carbohydrate assimilation as a whole is maintained probably as a result of using distal small intestine as well as of increased intestinal size.