Recognition system for dietary fatty acids in the small intestine and taste buds

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Fat in food is not only a source of essential nutrients, but also plays an important role in taste sensation. It is generally known that some laboratory animals, such as rats and mice, have a preference for high fat diets. Much attention has been paid to involvement of fat and triglycerides in the food texture, while few studies have been made on the sensation of fat, mainly because the size of oil droplets has been considered too large to bind to sensory receptors. However, postprandial lipid metabolism is affected by only exposure of the oral cavity to dietary fat, suggesting recognition of dietary fat in the oral cavity. Recently, Gilbertson et al. (1997), using the patch-clamp recording method, showed that the delayed-rectifying K^+ channel in gustatory cells of the taste bud was inhibited by Cis-unsaturated long chain fatty acids (LCFA), and suggested the presence of a sensory mechanism for fat in taste receptor cells.

Dietary fatty acids are known to be common stimulators of the release of several gastrointestinal hormones. Since fatty acids release most of the gastrointestinal hormones from the small intestine, a common system for the recognition of fatty acids is likely to exist in the intestinal epithelium. We have hypothesized that epithelial cells, including gut endocrine cells, and taste buds in the tongue would have a common system for recognizing fatty acid.

We found that the participation of a receptor protein in the fat-sensory mechanism of intestinal epithelial cells, and selective expression of a fatty-acid binding protein (FAT), originally expressed in adipose tissue, in the brush border of jejunal epithelial cells. Moreover, Northern blot analysis showed a significant expression of FAT mRNA in the epithelial layer of circumvallate papillae. Immunohistochemical staining revealed that immunoreactivity for FAT is specifically localized in the apical part of taste bud cells. These findings suggested that some dietary fat-detecting system similar to that in the intestinal epithelium exists in taste cells, and that FAT participates in the common fatty-acid sensory mechanisms. A series of our recent studies provide clues to the long-sought molecular and cellular basis for chemoreception in the oral cavity.

References

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