Intestinal manifestations in two layers of mucus in stomach and colon.

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Introduction

Gastric mucus is a gel-mucous barrier secreted in the stomach wall by epithelial cells and glandular cells. It serves as a barrier between the stomach wall and the acid and digestive enzymes present in the stomach lumen. Mucus-secreting cells are the most common cell type in the stomach, indicating the importance of mucus in stomach function.

Gastric mucus production

Because of its importance in maintaining the balance between health and sickness, the gut microbiota may be considered a vital "organ" of the human body. It's mostly found in the small intestine and colon, although the stomach has long been assumed to be sterile due to its high acid production. Until the discovery of Helicobacter pylori, the stomach was thought to be "a hostile site" for bacterial growth (HP). The stomach and its microbiota can now be thought of as two separate "organs" that share the same space and interact with one another. Indeed, the microscopic features of the stomach mucosa (mucus layer and luminal contents) have an impact on the local microbiota and vice versa [1].

Mucus in stomach

Mucins, which are big, glycosylated proteins, are vital for gastrointestinal luminal protection. Transmembrane mucins cover the apical surface of enterocytes, and goblet cells secrete the gel-forming mucins that make mucus. The small intestine has a single unconnected mucus layer, which gets adhered in cystic fibrosis and accounts for the disease's intestinal symptoms. The inner layer of mucus in the stomach and colon is attached, while the outside layer is less dense and unattached. The outer mucus layer of the colon serves as a home for commensal microorganisms. Surface goblet cells replace the inner mucus layer every hour, making it bacteria-resistant [2].

The crypt goblet cells can secrete mucus to restore the mucus layer, such as after an ischemic challenge. As part of their pathogenicity, parasitic and bacterial proteases can break mucins and disintegrate mucus. However, various other mechanisms, such as immune system malfunctions, can allow germs to penetrate the inner mucus layer. The immune system is stimulated and inflammation is generated when bacteria contact the epithelial surface. This mechanism may be present in some ulcerative colitis cases [2].

Mucus in colon

The human colon's mucus layer guards against commensal bacteria and pathogens, and faults in its bilayered structure contribute to intestinal illnesses including ulcerative colitis. However, the dearth of in vitro models that duplicate the structure and function of the human colonic mucus layer limits our understanding of colon physiology. We wanted to see if we could use a combination of organ-on-a-chip and organoid technologies to create a human-relevant in vitro model of colon mucus physiology [3].

The microfluidic device, which was lined with primary patient-derived colonic epithelial cells, was utilised to noninvasively visualise mucus accumulation in living cultures and to simulate mucus bilayer creation. While maintaining a subpopulation of proliferative epithelial cells, the Colon Chip enables spontaneous goblet cell differentiation and deposition of a mucus bilayer with impenetrable and penetrable layers and a thickness similar to that seen in the human colon. The colonic epithelium is stimulated with prostaglandin E2, which is increased during inflammation, causing rapid mucus volume expansion via a Na-K-Cl cotransporter 1 ion channel-dependent increase in its hydration state, but no increase in de novo mucus secretion, according to live imaging of the mucus layer formation on-chip [3].

Impact of mucus layers on stomach and colon

The bacterium *Helicobacter pylori* (*H. pylori*) has adapted to survive in the stomach's highly acidic environment and invade the gastric mucosa's epithelial surface. Its pathogenic effects, which include gastritis, peptic ulcers, and stomach cancer, are well established. The bacterium must migrate over the gel-like gastric mucus lining of the stomach under acidic circumstances in order to infect the stomach and establish colonies on the mucus epithelial surface. From a biophysical standpoint, we look at how the bacterium gets past the protective mucus barrier in this review. We start by going over the molecular structure of gastric mucin and then talk about what we know about mucin polymerization and low pH driven gelation right now [4].

Conclusion

This study demonstrates the in vitro generation of colonic mucus with a medically appropriate bilayer structure that can be examined noninvasively in real time. This could provide a new preclinical tool for investigating the role of mucus in human intestinal homeostasis and illnesses like ulcerative colitis and cancer.

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