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PHYSIOLOGY OF THE SECRETORY AND MOTOR FUNCTIONS OF THE GASTROINTESTINAL TRACT

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Abstract
The secretory and motor functions of the gastrointestinal tract (GIT) play a central role in the digestion, absorption of nutrients, and maintenance of homeostasis in the human body. This article provides a detailed analysis of the secretory mechanisms of the GIT, including gastric, pancreatic, and intestinal gland secretion processes, as well as motor activity patterns such as peristalsis and segmentation. The mechanisms of secretory–motor coordination are examined based on the integration of the enteric nervous system, the autonomic nervous system, and gastrointestinal hormones. Modern theoretical concepts of GIT function are presented through the analysis of contemporary scientific literature.
Keywords: gastrointestinal tract, secretion, motility, peristalsis, enteric nervous system, gastrointestinal hormones, homeostasis.

Introduction

The gastrointestinal tract is a complex morphofunctional system responsible for the mechanical and chemical processing of food, enzymatic digestion, and nutrient absorption. The efficiency of these processes depends on the coordinated and integrated functioning of secretory and motor activities.

In modern physiology, the GIT is regarded as a “neurohumorally integrated system.” Hall and Guyton (2021) emphasize that processes occurring within the gastrointestinal tract are regulated by the central nervous system, enteric plexuses, and endocrine signals. Boron and Boulpaep (2022) describe the gastrointestinal system as a “semi-autonomous regulatory system,” noting that many of its reflex responses occur independently of central control.

Uzbek scholar Sh.A. G‘ulomov (2019) characterizes digestive physiology as a multi-stage regulatory mechanism and highlights the close interdependence between secretion and motility in ensuring effective gastrointestinal function.

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1. Expanded Physiological Foundations of Secretory Activity. Secretory activity constitutes the chemical phase of digestion. During this process, glandular cells release enzymes, acids, bicarbonates, and mucus, which are essential for the breakdown and processing of food.

Gastric Secretion. The gastric glands are composed of three main types of cells: Parietal cells**,** which produce hydrochloric acid (HCl) and intrinsic factor, chief cells**,** which secrete pepsinogen, mucous cells**,** which produce mucus. Gastric secretion occurs in three distinct phases.The cephalic phase**,** mediated by activation of the vagus nerve in response to visual, olfactory, and taste stimuli, the gastric phase**,** associated with gastric wall distension and gastrin release, the intestinal phase**,** regulated primarily by secretin and cholecystokinin. According to Johnson (2018), gastrin and histamine exert a synergistic effect that enhances the activity of proton pumps, thereby increasing gastric acid secretion**.**

Pancreatic and Intestinal Secretion. Pancreatic enzymes, including amylase, lipase, and trypsin, are released into the duodenum, where they play a crucial role in the digestion of macromolecules. Secretin stimulates bicarbonate secretion, which neutralizes the acidic chyme entering the small intestine. As noted by Islomov (2020), impairment of pancreatic secretion may contribute to the development of metabolic syndrome and malabsorption syndromes.

2. Expanded Mechanisms of Motor Activity. Motor activity ensures the propulsion and mixing of food masses within the gastrointestinal tract. It manifests in the following forms: Peristalsis, segmentation, tonic contractions

Peristaltic Reflex. Peristalsis is a reflex response triggered by distension of the intestinal wall. Through the Auerbach (myenteric) plexus, contraction occurs in the segment behind the bolus, while relaxation occurs in the segment ahead of it. Serotonin is one of the principal mediators that activate this reflex. Hall (2021) describes peristalsis as a “propulsive movement mechanism” responsible for the forward movement of intestinal contents.

Segmentation and Mixing. Segmental contractions effectively mix the food mass with digestive enzymes and increase the absorptive surface area of the intestinal mucosa. Karimov (2018) experimentally demonstrated that intestinal motility is regulated by sympathetic and parasympathetic impulses, with the sympathetic system generally inhibiting and the parasympathetic system stimulating motor activity.

3. Neurohumoral Integration. Secretory and motor activities of the gastrointestinal tract are coordinated through a complex neurohumoral regulatory system. Enteric Nervous System.The enteric nervous system (ENS) consists of two principal plexuses: The Auerbach (myenteric) plexus, primarily responsible for motor regulation, The Meissner (submucosal) plexus, mainly involved in the regulation of secretory activity. The ENS is capable of generating independent reflexes and regulating gastrointestinal functions autonomously, even in the absence of direct central nervous system control.

Hormonal Regulation. The main gastrointestinal hormones involved in regulatory processes include:

1. **Gastrin**
2. **Secretin**
3. **Cholecystokinin (CCK)**
4. **Motilin**

Boron and Boulpaep (2022) describe this regulatory system as a coordinated interaction of “feedback and feedforward mechanisms,” ensuring the balance and efficiency of digestive processes.

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4. Clinical Significance of Secretory and Motor Activity. Disturbances in secretory and motor functions of the gastrointestinal tract may lead to various pathological conditions, including:

1. **Gastritis**
2. **Peptic ulcer disease**
3. **Intestinal atony**
4. **Irritable bowel syndrome (IBS)**

G‘ulomov (2019) associates gastrointestinal dysfunctions with impairments in autonomic regulation, emphasizing the critical role of neurovegetative balance in maintaining normal digestive physiology.

Conclusion

Modern scientific research increasingly characterizes the gastrointestinal tract not only as a system responsible for digestion, but also as a complex structure integrated with immune, neuroendocrine, and metabolic processes. Concepts such as the influence of intestinal microbiota on secretion and motility, as well as the interaction between the enteric nervous system and the central nervous system (the “gut–brain axis”), have significantly expanded contemporary scientific perspectives in this field.

The secretory and motor functions of the gastrointestinal tract constitute an integral component of vital physiological activity, and their coordinated and balanced performance is essential for maintaining overall health. A comprehensive understanding of these processes is important not only for theoretical physiology but also for clinical practice, gastroenterology, and the prevention of metabolic disorders. Future research should adopt an integrated approach at the molecular, neurophysiological, and microbiological levels in order to further elucidate the complex regulatory mechanisms underlying gastrointestinal function.

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