**بسم الله الرحمن الرحيم**

**Lecture -6- Medical Physiology (GIT system)**

**2nd stage Dr. Noor Jawad**

**PANCREATIC SECRETION**

 ***Objectives of our lecture:***

***1. Regulation of pancreatic secretions?***

***2. phases of pancreatic secretions?***

The pancreas, which lies parallel to and beneath the stomach ,is a large compound gland .The pancreatic digestive enzymes are secreted by pancreatic acini, and large volumes of sodium bicarbonate solution are secreted by the small ductules and larger ducts leading from the acini.

Pancreatic juice is secreted most abundantly in response to the presence of chyme in the upper portions of the small intestine, and the characteristics of the pancreatic juice are determined to some extent by the types of food in the chyme. (The pancreas also secretes insulin, but it is not secreted by the same pancreatic tissue that secretes intestinal pancreatic juice. Instead, insulin is secreted directly into the blood—not into the intestine— by the islets of Langerhans that occur in islet patches throughout the pancreas.

**PANCREATIC DIGESTIVE ENZYMES**

Pancreatic secretion contains multiple enzymes for digesting all of the three major types of food: **proteins, carbohydrates, and fats**. It also contains large quantities of bicarbonate ions, which play an important role in neutralizing the acidity of the chyme emptied from the stomach into the duodenum. The most important of the pancreatic enzymes for digesting proteins are **trypsin, chymotrypsin, and carboxypolypeptidase**. By far the most abundant of these is trypsin. Trypsin and chymotrypsin split whole and partially digested proteins into peptides of various sizes but do not cause release of individual amino acids. However, carboxypolypeptidase splits some peptides into individual amino acids, thus completing digestion of some proteins all the way to the amino acid state. The pancreatic enzyme for digesting carbohydrates is pancreatic amylase, which hydrolyzes starches, glycogen, and most other carbohydrates (except cellulose) to form mostly disaccharides and a few trisaccharides.

The main enzymes for fat digestion are (1) *pancreatic lipase,* which is capable of hydrolyzing neutral fatinto fatty acids and monoglycerides; (2) *cholesterolesterase,* which causes hydrolysis of cholesterol esters;and (3) *phospholipase,* which splits fatty acids from phospholipids.

**REGULATION OF PANCREATIC SECRETION**

Three basic stimuli are important in causing pancreatic secretion:

**1**. Acetylcholine, which is released from the parasympathetic vagus nerve endings and from other cholinergic nerves in the enteric nervous system

 **2**. Cholecystokinin, which is secreted by the duodenal and upper jejunal mucosa when food enters the small intestine

 **3**. Secretin, which is also secreted by the duodenal and jejunal mucosa when highly acidic food enters the small intestine

The first two of these stimuli, acetylcholine and cholecystokinin, stimulate the acinar cells of the pancreas, causing production of large quantities of pancreatic digestive enzymes but relatively small quantities of water and electrolytes to go with the enzymes Secretin, in contrast to the first two basic stimuli, stimulates secretion of large quantities of water solution of sodium bicarbonate by the pancreatic ductal epithelium.

**Phases of Pancreatic Secretion**

Pancreatic secretion, as with gastric secretion, occurs in three phases: the cephalic phase, the gastric phase, and the intestinal phase. Their characteristics are described in the following sections.

1. **Cephalic and Gastric Phases**.

During the cephalic phase of pancreatic secretion, the same nervous signals from the brain that cause secretion in the stomach also cause acetylcholine release by the vagal nerve endings in the pancreas. This signaling causes moderate amounts of enzymes to be secreted into the pancreatic acini, accounting for about 20 percent of the total secretion of pancreatic enzymes after a meal. However, little of the secretion flows immediately through the pancreatic ducts into the intestine because only small amounts of water and electrolytes are secreted along with the enzymes. During the gastric phase, the nervous stimulation of enzyme secretion continues, accounting for another 5 to 10 percent of pancreatic enzymes secreted after a meal However, again, only small amounts reach the duodenum because of continued lack of significant fluid secretion.

1. **Intestinal Phase.** After chyme leaves the stomach and enters the small intestine, pancreatic secretion becomescopious, mainly in response to the hormone *secretin*.

Thank you

References : Guyton and Hall textbook of medical physiology, thirteen ed