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Gastrointestinal Hormones

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Introduction:

Gastrointestinal (GI) hormones are the hormones produced in GI tract. These hormones are related to polypeptides belonging to the family of local hormones. The main functions of this hormones is to control the secretory activity and motility of the GI tract.

Cells secreting the hormones:

Enteroendocrine cells:

Enteroendocrine are the cells secreting in GI tract. These are nerve cells and glandular cells which are observed in gastric mucosa, intestinal mucosa and the pancreatic cells.

Neuroendocrine cells or APUD cells:

Enteroendocrine cells which secrete hormones from amines are termed as amine precursor uptake and decarboxylation cells or APUD cells. For the synthesis of GI hormones, first a precursor substance of an amine is taken up by these cells. Afterwards, this precursor substance is decarboxylated and results in the formation of the amine. From this amine synthesis of hormone occurs. Due to the uptake of the amine precursor and decarboxylation of this precursor substance, these cells are termed as APUD cells. This type of cells is also observed in other parts of the body especially the brain, lungs and endocrine glands.

Enterochromaffin cells:

Enteroendocrine cells which secrete seratonin are known as enterochromaffin cells.

DESCRIPTION OF GASTROINTESTINAL HORMONES

Cholecystokinin (CCK):

CCK consists of 39 aminoacids residues. Previously it was considered that there were two separate hormones such as pancreozymin and CCK. It was thought that pancreozymin activated the secretion of pancreatic juice along large amount of enzymes and CCK activated the secretion of gallbladder. But now, it is well known that the same hormone shoes the actions on both pancreas as well as gallbladder. Finally pancreozymin (cck-p2) or CCK. The secretion of CCK by I cells in mucosa of duodenum and jejunum. The secretion of a small quantity of the hormone occurs in the ileum also.

Stimulant of secretion:

Stimulant for the release of this hormones is presence of chyme containing digestive products of fats and proteins namely fatty acids, peptides and aminoacids particularly in the upper part of intestine.

Functions:

Major functions of CCK

1.Vontracts gallbladder

2.Activazes exocrine pancreatic secretions. It also activate pancreatic acinar cells via the second messenger i.e inositol triphosphate. Cholecystokinin is responsible for secretion of pancreatic juice along with more amount of enzymes.

Other functions:

Cholecystokinin

1.Enhances the activity of secretin for producing alkaline pancreatic juice, with more amount of bicarbonate ions.

2.Enhances the contraction of pyloric sphincter.

3.Enhances the secretion of enterokinase.

4.Induces drug tolerance to opioids.

5.Plays an vital role in satiety by suppressing hunger.

6.Increases the movements of intestine.

Gastrin:

Gastrin is a peptide and consisting of 34 Amin acid residues. The secretion of gastrin takes place primarily by the G cells of pyloric glands of stomach. It is also produced by TG cells in stomach, duodenum and jejunum. In fetus, the islets of langerhans of pancreas also secrete this hormone. Gastrin is secreted from stomach during the gastric (second) phase of gastric secretion and from small intestine during the intestinal (third) phase of gastric secretion.

Stimulant of secretion:

Stimulants for secretion of gastrin are:

1.Presence of food in the stomach.

2.Activation of local nervous plexus in stomach and small intestine.

Vagovagal reflex during the gastric phase of

gastric secretion. The release of Gastrin-releasing polypeptide occurs at the vagal nerve ending. It is responsible for the secretion of gastrin by activating the G cells or TG cells.

Functions:

Gastrin

1.Stimulates gastric glands to secrete gastric juice with more pepsin and hydrochloric acid.

2.Accelerates gastric motility

3.Promotes growth of gastric mucosa.

4.Stimulates secretion of pancreatic juice, which is rich in enzymes.

5.Stimulates islets of Langerhans in pancreas to release pancreatic hormones.

Ghrelin:

Ghrelin is recently discovered hormone. Ghrelin contains 28 amino acids. The synthesis of Ghrelin occurs by epithelial cells in the fundus of stomach. The production of Ghrelin also occur in small amounts particularly in pituitary, hypothalamus, kidney and placenta.

Stimulant for secretion:

Secretion of ghrelin increases during fasting and decreases when stomach is full.

Functions of Ghrelin:

1.Induces appetite and food intake by acting via feeding center in hypothalamus.

2.Stimulates gastric emptying.

3.Promotes the secretion of growth hormone (GH) by stimulating somatotropes (growth hormone synthesizing cells) in anterior pituitary. Receptors for this hormone called growth hormone Secretogogues receptor (GHS-R) were identified in the somatotropes before the discovery of the hormone itself. These receptors are also found in adipose tissue, heart and hypothalamus.

Glicentin:

Glicentin is a polypeptide and the secretion of glicentin occurs by L cells in duodenum and jejunum and alpha cells of pancreatic islets. It is also secreted in brain. Precursor of this hormone is known as preproglycagon. In intestine, the conversion of preproglycagon takes place into glicentin and glucagon like polypeptide-2. In pancreas it is changed into glucagon, glucagon like polypeptide-1 and main proglucagon fragment.

Stimulant for Secretion:

The secretion of glicentin, occurs if chyme with fat and protein arrives the intestine.

Action:

Like glucagon, glicentin also enhances the blood sugar level.

Glucagon:

Glucagon consists of 29 aminoacids. The secretion of glucagon occurs by alpha cells of islets of langerhans in pancreas. The secretion of glucagon also takes place by A cells in the stomach and L cells in the intestine. In intestine, it is produced as preproglucagon.

Stimulants for secretion:

Presence of food with more fat and protein in the stomach is the stimulant for glucagon secretion in stomach and duodenum. Hypoglycemia acts as the stimulant for secretion of pancreatic glucagon.

Action

Glucagon enhances blood sugar level.

Glucagon like polypeptide-1 (GLP-1)

The secretion GLP-1 occurs in alpha cells of pancreatic islets. Structurally GLP-1 similar GLP-2 and glucagon. GLP-1 is also seen in brain.

Stimulant for secretion:

Presence of food with glucose is small intestine enhances the release of GLP-1.

Functions:

1.Enhaces the insulin secretion from beta cells of islets of langerhans of pancreas.

2.Inhibits gastric motility.

Glucagon-Like peptide (GLP-2):

GLP-2 is secreted by L cells in ileum and Colon. Structurally it is similar to GLP-1 and glucagon. Like GLP-1, GLP-2 is also observed.

Stimulant for secretion:

Presence of food with glucose in the small intestine enhances the release of GLP-2 also.

Function:

GLP-2 inhibits appetite.

Motilin:

Motilin contains 22 amino acid residues. The secretion of motilin occurs by Mo cells. Mo cells are stomach as well as intestine. It is also believed to secreted especially by enterochromaffin cells of intestine.

Stimulant for secretion:

The secretion of motilin happens if the chyme from stomach enters the duodenum.

Functions of Motilin:

1.Accelerates gastric emptying.

2.Enhances the mixing and propulsion movements of small intestine.

3.Enhances the peristalsis of colon.

Neuropeptide Y

Neuropeptide Y contains 36 aminoacids. It is structurally to pancreatic polypeptid and peptide y y. The secretion of neuropeptide happens by enteric nerve endings especially in ileum and colon. The secretion of neuropeptide Y also occurs in hypothalamus, neurons of ANS and medulla.

Stimulant for secretion:

Secretion of neuropeptide Y happens with the help of fat containing chyme.

Function:

Neuropeptide Y enhances the blood flow particularly in enteric blood vessels and activates the food intake.

Pancreatic polypeptid:

Pancreatic polypeptid is a polypeptide and it contains 36 amino acid residues. The secretion of pancreatic polypeptid primarily by the PP cells of the islets of langerhans in pancreas. Pancreatic polypeptid is also observed in small intestine.

Stimulant for secretion:

The secretion of pancreatic polypeptid occurs by the presence of chyme with proteins in small intestine. It is also secreted in a very few conditions namely exercise, fasting and hypoglycemia.

Functions:

Enhances the secretion of glucagon from alpha cells of islets of langerhans in pancreas.

Reduces the secretion of pancreatic juice from exercise part of pancreas.

Peptide YY:

Peptide YY contains 36 amino acid residues. It is resembles pancreatic polypeptid and neuropeptide Y regarding structural point of view. The secretion of peptide YY also occurs in L cells of ileum and colon.

Stimulus for secretion:

Presence of fat containing chyme enhances the release of peptide YY.

Functions of peptide YY:

1.Inhibits gastric motility as well as gastric secretion.

2.Inhibits the intestinal motility and prevents passage of bowel beyond Ileum.

3.Reduces secretion of pancreatic juice.

4.Stops appetite and food intake.

Somatostatin:

Somatostatin was first observed in brain it is also know as growth hormone inhibiting hormone (GHIH). Presently it is observed in D cells of stomach as well as upper part of small intestine. D cells of pancreatic islets also secrets somatostatin. The secretion of somatostatin occurs in two forms that is one with 14 aminoacids and the other with 28 amino acids.

Stimulant for secretion:

Somatostatin is released because of chyme with glucose and proteins in stomach as well as small intestine.

Functions of somatostatin:

Inhibits gastric secretion as well as motility.

Inhibits production of pancreatic juice.

Stops secretion of growth hormone (GH) and thyroid stimulating hormone (TSH) fr anterior pituitary.

Stops secretion of GI hormones namely gastrin, GIP and VIP.

Substance-P:

Substance-p is neurotransmitter and it contains 11 amino acid residues. The secretion of substance-p occurs at the pain nerve endings in brain and enteric nerve endings especially in small intestine.

Stimulant for secretion:

Presence of chyme results in the release of substance-p in intestine.

Functions of substance-p:

Substance-p enhances the mixing as well as propulsive movements of small intestine.

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