DIGESTION AND ABSORPTION OF PROTEINS WITH CLINICAL CORRELATIONS
OBJECTIVES

1. To define digestion
2. to describe the digestion process of protein
3. To define gastric secretions and the functions of its constituents
4. to describe the mechanism of secretion of gastric acid
5. to state the control of gastric acid secretion
6. To define Alkaline Tide
7. To differentiate between gastric and pancreatic proteases
8. To state the mechanism of protein absorption
9. To discuss Gluten Enteropathy (Celiac disease)
**DIGESTION:**

Digestion is the chemical breakdown of large food molecules into smaller molecules that can be used by cells.

The breakdown occurs when certain specific enzymes are mixed with the food.
MAIN COMPONENTS OF FOOD ARE:

- Proteins
- Carbohydrates
  - Monosaccharides
  - Disaccharides
  - Polysaccharides
- Lipids
Protein digestion begins in the stomach. Its walls are composed of strong muscles. These muscles mix and churn the ingested food. Their function is to secrete gastric juice, which is a colorless and strong acidic liquid at a pH of 1-3.
THE MAIN COMPONENTS OF GASTRIC JUICE ARE:

1. Mucus.

2. Hydrochloric acid

3. Digestive enzymes, (proteases)
1. MUCOSAL PROTECTION

Mucus layer on gastric surface forms a mucosal barrier to damage against several forms of potential injury to the gastric mucosa.

1. A gel 0.2mm thick; 80% CHO; 20% protein
2. Secreted by neck cells, surface epithelium
3. Can be cleaved by pepsin, so continual production is required
4. Release is stimulated by acetylcholine from nerve endings
5. Also rich in bicarbonate
6. HCO$_{-3}$ content creates a "micro-environment" around surface cells to prevent acid damage
7. HCO$_{-3}$ secretion is inhibited by adrenergic input (prominent in stress)
2. ACID SECRETION

2.1. Function of Gastric acid

1. To kill micro-organisms: (but H. pylori survives by making ammonia (basic) from urea using urease).
2. To provide the optimal pH for pepsin action
3. To activate pepsinogens (cleaved to form pepsin)
4. Facilitating absorption of iron by converting colloidal iron into ionic form.
5. Stimulating duodenum to liberate secretin
6. Breaks down connective tissue in food
2.2. MECHANISM OF GASTRIC ACID SECRETION
2.3. CONTROL OF GASTRIC ACID SECRETION
1. Acid at less than pH 2 is a direct inhibitor of acid release.

2. Acid in duodenum releases secretin which inhibits gastric secretion.
"Alkaline tide during gastric secretion: Owing to secretion of a large amount of $H^+$ as $HCl$, there is surplus of $OH^-$ in the parietal cell which is taken up not only by the $CO_2$ to form $HCO_3^-$ but also by other buffer systems of parietal cell initially and later by those of plasma.

\[
\frac{HPO_4^{2-}}{H_2PO_4^-} \quad \frac{HCO_3^-}{H_2CO_3} \quad \frac{Lactate}{Lactic acid}
\]

"All tend to increase on the side of the base i.e.: $HPO_4^{2-}$, $HCO_3^-$ and lactate, with the result that the pH of plasma is raised and an alkaline urine is excreted for some hours following intake of food and gastric secretion. This is known as the alkaline tide."
3. GASTRIC AND PANCREATIC PROTEASES:

**Proteolytic Degradation of Dietary Protein**

Substrate (dietary protein)

- Tyr
- Phe
- Leu
- Arg
- Lys
- Trp
- Phe
- Tyr
- Met
- Leu
- Ala
- Gly
- Ser
- H⁺
- pepsinogen
- pepsin
- enteropeptidase (enterokinase) (intestine)
- Carboxyl protease
- Stomach
- Serine proteases
- Pancreas
- trypsinogen
- trypsin
- chymotrypsinogen
- chymotrypsin
- elastase
- proelastase
ABSORPTION OF AMINO ACIDS AND PEPTIDES
Celiac disease is an autoimmune digestive disease that damages the villi of the small intestine and interferes with absorption of nutrients from food. Essentially the body is attacking itself every time a person with celiac consumes gluten.
1. The intestinal damage can cause weight loss, bloating and sometimes diarrhea. Eventually, the brain, nervous system, bones, liver and other organs can be deprived of vital nourishment.

2. In children, malabsorption can affect growth and development. The intestinal irritation can cause stomach pain, especially after eating.

3. There's no cure for celiac disease — but following a strict gluten-free diet can help manage symptoms and promote intestinal healing.
1. **Digestion** is the chemical breakdown of large food molecules into smaller molecules that can be used by cells. The breakdown occurs when certain specific enzymes are mixed with the food.

2. Protein digestion begins in the stomach where it secrete gastric juice. The bulk of protein digestion is due to the pancreatic proteases.

3. The main components of gastric juice are:
   1. Mucus.
   2. Hydrochloric acid and
   3. Digestive enzymes, (proteases)
4. Mechanism of secretion of gastric acid is presented in the text.
5. Control of gastric acid secretion is by the action of:
   1. ACETYLCHOLINE
   2. GASTRIN
   3. HISTAMINE
6. Owing to secretion of a large amount of $H^+$ as HCl, there is surplus of $OH^-$ in the parietal cell which is taken up not only by the $CO_2$ to form $HCO_3^-$ but also by other buffer systems of parietal cell initially and later by those of plasma. All tend to increase on the side of the base i.e.: $HPO_4^{2-}$, $HCO_3^-$ and lactate, with the result that the pH of plasma is raised and an alkaline urine is excreted for some hours following intake of food and gastric secretion. This is known as the alkaline tide.
9. **Celiac disease** is an autoimmune digestive disease that damages the villi of the small intestine and interferes with absorption of nutrients from food. Essentially the body is attacking itself every time a person with celiac consumes gluten.
ANY QUESTIONS