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18/ENG08/012
Biomedical engineering
Ana226 assignment

Digestive Processes of The Food Miss Egbe ate in the party.

Recall that she ate Fried rice(carbohydrate), fried chicken(protein and fat&oil because of the oil used to fry the chicken) salad(vitamins), water.

1) Ingestion:

The large molecules found in intact food cannot pass through the cell membranes. Food needs to be broken into smaller particles so that animals can harness the nutrients and organic molecules. The first step in this process is ingestion. Ingestion is the process of taking in food through the mouth. In vertebrates, the teeth, saliva, and tongue play important roles in mastication (preparing the food into bolus). While the food is being mechanically broken down, the enzymes in saliva begin to chemically process the food as well. The combined action of these processes modifies the food from large particles to a soft mass that can be swallowed and can travel the length of the esophagus.

2) Digestion and Absorption:

Digestion is the mechanical and chemical break down of food into small organic fragments. It is important to break down macromolecules into smaller fragments that are of suitable size for absorption across the digestive epithelium. Large, complex molecules of proteins, polysaccharides, and lipids must be reduced to simpler particles such as simple sugar before they can be absorbed by the digestive epithelial cells. Different organs play specific roles in the digestive process. The animal diet needs carbohydrates, protein, and fat, as well as vitamins and inorganic components for nutritional balance. How each of these components is digested is discussed in the following sections;

a)Carbohydrates:

The digestion of carbohydrates begins in the mouth. The salivary enzyme amylase begins the breakdown of food starches into maltose, a disaccharide. As the bolus of food travels through the esophagus to the stomach, no significant digestion of carbohydrates takes place. The esophagus produces no digestive enzymes but does produce mucous for lubrication. The acidic environment in the stomach stops the action of the amylase enzyme.
The next step of carbohydrate digestion takes place in the duodenum. Recall that the chyme from the stomach enters the duodenum and mixes with the digestive secretion from the pancreas, liver, and gallbladder. Pancreatic juices also contain amylase, which continues the breakdown of starch and glycogen into maltose, a disaccharide. The disaccharides are broken down into monosaccharides by enzymes called maltases
, sucrases, and lactases, which are also present in the brush border of the small intestinal wall. Maltase breaks down maltose into glucose. Other disaccharides, such as sucrose and lactose are broken down by sucrase and lactase, respectively. Sucrase breaks down sucrose (or “table sugar”) into glucose and fructose, and lactase breaks down lactose (or “milk sugar”) into glucose and galactose. The monosaccharides (glucose) thus produced are absorbed and then can be used in metabolic pathways to harness energy. The monosaccharides are transported across the intestinal epithelium into the bloodstream to be transported to the different cells in the body.

b)Protein

A large part of protein digestion takes place in the stomach. The enzyme pepsin plays an important role in the digestion of proteins by breaking down the intact protein to peptides, which

are short chains of four to nine amino acids. In the duodenum, other enzymes— trypsin, elastase, and chymotrypsin—act on the peptides reducing them to smaller peptides. Trypsin elastase, carboxypeptidase, and chymotrypsin are produced by the pancreas and released into the duodenum where they act on the chyme. Further breakdown of peptides to single amino acids is aided by enzymes called peptidases (those that break down peptides). Specifically, carboxypeptidase, dipeptidase, and aminopeptidase play important roles in reducing the peptides to free amino acids. The amino acids are absorbed into the bloodstream through the small intestines.

c)Lipids

Lipid digestion begins in the stomach with the aid of lingual lipase and gastric lipase. However, the bulk of lipid digestion occurs in the small intestine due to pancreatic lipase. When chyme enters the duodenum, the hormonal responses trigger the release of bile, which is produced in the liver and stored in the gallbladder. Bile aids in the digestion of lipids, primarily triglycerides by emulsification. Emulsification is a process in which large lipid globules are broken down into several small lipid globules. These small globules are more widely distributed in the chyme rather than forming large aggregates. Lipids are hydrophobic substances: in the presence of water, they will aggregate to form globules to minimize exposure to water. Bile contains bile salts, which are amphipathic, meaning they contain hydrophobic and hydrophilic parts. Thus, the bile salts hydrophilic side can interface with water on one side and the hydrophobic side interfaces with lipids on the other. By doing so, bile salts emulsify large lipid globules into small lipid globules.
Why is emulsification important for digestion of lipids? Pancreatic juices contain enzymes called lipases (enzymes that break down lipids). If the lipid in the chyme aggregates into large globules, very little surface area of the lipids is available for the lipases to act on, leaving lipid digestion incomplete. By forming an emulsion, bile salts increase the available surface area of the lipids many fold.

d)Vitamins

Vitamins can be either water-soluble or lipid-soluble. Fat soluble vitamins are absorbed in the same manner as lipids. It is important to consume some amount of dietary lipid to aid the absorption of lipid-soluble vitamins. Water-soluble vitamins can be directly absorbed into the bloodstream from the intestine.

Water: when taken aids digestion

4)Elimination/Egestion:

The final step in digestion is the elimination of undigested food content and waste products. The undigested food material enters the colon, where most of the water is reabsorbed. Recall that the colon is also home to the microflora called “intestinal flora” that aid in the digestion process. The semi-solid waste is moved through the colon by peristaltic movements of the muscle and is stored in the rectum. As the rectum expands in response to storage of fecal matter, it triggers the neural signals required to set up the urge to eliminate. The solid waste is eliminated through the anus using peristaltic movements of the rectum.

HOW THE DIGESTIVE SYSTEM WORKS
This system consists of what’s called the alimentary canal. Which starts from the mouth till the anus.

1) Mouth:
The mouth is the beginning of the digestive tract. In fact, digestion starts here as soon as you take the first bite of a meal. Chewing breaks the food into pieces that are more easily digested, while saliva mixes with food to begin the process of breaking it down into a form your body can absorb and use.

2)Pharynx:
Also called the throat, the throat is the next destination for food you've eaten (in this case Miss Egbe Amanda). From here, food travels to the esophagus or swallowing tube.

3) Esophagus
The esophagus is a muscular tube extending from the pharynx to the stomach. By means of a series of contractions, called peristalsis, the esophagus delivers food to the stomach. Just before the connection to the stomach there is a "zone of high pressure," called the lower esophageal sphincter; this is a "valve" meant to keep food from passing backwards into the esophagus.

4) Stomach:
The stomach is a sac-like organ with strong muscular walls. In addition to holding the food, it's also a mixer and grinder. The stomach secretes acid and powerful enzymes that continue the process of breaking down the food. When it leaves the stomach (after 3-4hours for some certain classes of food), food is the consistency of a liquid or paste. From there the food moves to the small intestine.

5) Small Intestine
Made up of three segments, the duodenum, jejunum, and ileum, the small intestine is a long tube loosely coiled in the abdomen (spread out, it would be more than 20 feet long). The small intestine continues the process of breaking down food by using enzymes released by the pancreas and bile from the liver. Bile is a compound that aids in the digestion of fat and eliminates waste products from the blood. Peristalsis (contractions) is also at work in this organ, moving food through and mixing it up with digestive secretions. The duodenum is largely responsible for continuing the process of breaking down food, with the jejunum and ileum being mainly responsible for the absorption of nutrients into the bloodstream.
Note that three organs play a pivotal role in helping the stomach and small intestine digest food:

a)Pancreas
Among other functions, the oblong pancreas secretes enzymes into the small intestine. These enzymes break down protein, fat, and carbohydrates from the food we eat.

b)Liver
The liver has many functions, but two of its main functions within the digestive system are to make and secrete bile, and to cleanse and purify the blood coming from the small intestine containing the nutrients just absorbed.

C) The Gallbladder

The gallbladder is a pear-shaped reservoir that sits just under the liver and stores bile. Bile is made in the liver then if it needs to be stored travels to the gallbladder through a channel called the cystic duct. During a meal, the gallbladder contracts, sending bile to the small intestine.

Immediately nutrients have been absorbed and the leftover liquid has passed through the small intestine, what is left of the food you ate is handed over to the large intestine, (or colon).

6) Colon (Large Intestine)

The colon is a 5- to 6-foot-long muscular tube that connects the cecum (the first part of the large intestine to the rectum (the last part of the large intestine). It is made up of the cecum, the ascending (right) colon, the transverse (across) colon, the descending (left) colon, and the sigmoid colon (so-called for its "S" shape; the Greek letter for S is called the sigma), which connects to the rectum.

Stool, or waste left over from the digestive process, which is passed through the colon by means of peristalsis (contractions), first in a liquid state and ultimately in solid form as the water is removed from the stool. A stool is stored in the sigmoid colon until a "mass movement" empties it into the rectum once or twice a day. It normally takes about 36 hours for stool to get through the colon. The stool itself is mostly food debris and bacteria. These bacteria perform several useful functions, such as synthesizing various vitamins, processing waste products and food particles, and protecting against harmful bacteria.

7) Rectum

The rectum (Latin for "straight") is an 8-inch chamber that connects the colon to the anus. It is the rectum's job to receive stool from the colon, to let you know there is stool to be evacuated, and to hold the stool until evacuation happens. When anything (gas or stool) comes into the rectum, sensors send a message to the brain. The brain then decides if the rectal contents can be released or not. If they can, the sphincters (muscles) relax and the rectum contracts, expelling its contents. If the contents cannot be expelled, the sphincters contract and the rectum accommodates, so that the sensation temporarily goes away.

8)Anus
The anus is the last part of the digestive tract. It consists of the pelvic floor muscles and the two anal sphincters (internal and external muscles). The lining of the upper anus is specialized to detect rectal contents. It lets us know whether the contents are liquid, gas, or solid. The pelvic floor muscle creates an angle between the rectum and the anus that stops stool from coming out when it is not supposed to. The anal sphincters provide fine control of stool. The internal sphincter keeps us from going to the bathroom when we are asleep, or otherwise unaware of the presence of stool. When we get an urge to go to the bathroom, we rely on our external sphincter to keep the stool in until we can get to the toilet.