

Middle and High School Curriculum

NUTRITION 101

LESSON ONE THE DIGESTIVE SYSTEM

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student
notes





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NUTRITION 101

LESSON 1

The Digestive System

STUDENT-FRIENDLY OBJECTIVE

I will examine how foods are absorbed, what is needed for this food absorption (hydrochloric acid, enzymes, probiotics), and how my food choices affect my mood.

Part 1

THE BASICS OF THE DIGESTIVE SYSTEM

- The digestive system is similar to your household plumbing pipes - carrying water into and out of your house. If something is "plugged up" everything will shut down or not work optimally.
- The digestive system is one long tube extending from the mouth all the way down through the large intestine (mouth, esophagus, stomach, small intestine, large intestine, liver, gallbladder and pancreas).
- The digestive tubes actively absorb, secrete, send signals and metabolize.
- A well-nourished digestive system keeps us smarter, stronger and disease free.
- We are eating a variety and quantity of foods that we assume our plumbing system can handle... and it does to a certain degree.
- The digestive system doesn't appreciate the fast food (or other crazy things we may eat when dared) and we will experience digestive problems.
- It's optimal to chew food between 25 to 50 times (or sing Happy Birthday before swallowing). The team combination of saliva and chewing allows a perfect start in the digestion process.



Crazy cool fact! The digestive system processes hundreds of pounds of food each year.

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- The uvula, the dangling piece of tissue at the back of your mouth, does some food directing. It makes sure food does not go up nasal passage and into your nose.
 - The salivary glands, located in the mouth, will begin to secrete saliva. Saliva contains water and chemical enzymes which help break down the food and make it soft and wet so it can be swallowed.
 - This liquidy food is called chyme. A ball of chyme is called a bolus.
 - After food leaves the mouth it goes down the esophagus.
 - The stomach is about the size of a pear and can be called the body's blender. It chops, dices and makes swallowed food a more liquidy chyme.
 - It does this with the help of enzymes called gastric juices. There are different types of gastric juices that break down different types of food. Pepsin helps break down protein for example.
 - Hydrochloric acid is secreted to help protect the stomach from germ invaders that might be present in foods. It is quite powerful and could easily burn your outside skin but the stomach is lined with mucus to make sure that doesn't happen.
 - Although nutrients are absorbed throughout the digestive track, most nutrients are absorbed in the small intestine.
 - Explore the 3 sections of the small intestine: duodenum, jejunum and ileum. The small intestine is approximately 4.6 meters (15 feet) and is 2.5 to 3 cm wide. Most of the nutrients are absorbed in the jejunum because the villi are much longer here and more plentiful.
 - Villi are finger-like projections located in the small intestine. There are millions of them. The food particles/nutrients in the chyme will travel up the villi towards the blood vessels where they will be absorbed into the bloodstream and used to fuel your body or be stored in the liver until needed.
 - The pancreas is located on your left side of your body by the stomach. It secretes pancreatic juices—chemicals called enzymes that help to further break down the chyme—into the small intestine to help digest food.



Whoa... what if you lose up to 75% of your liver? No worries, the liver can regenerate from as little as 25 percent of its own tissue into a whole liver again.



- The liver is on your right side and it has hundreds of jobs in the body such as storing nutrients, making bile to be stored in the gallbladder, helps clear the body of toxins from drugs and even helps fight off bacteria and viruses. The liver weighs about 3 pounds and is shaped similar to a rounded triangle.
- The gallbladder is located on top of your liver and it stores bile, which aids in breaking down fat.
- The large intestine is much smaller than the small intestine in length but bigger in width. It is approximately 1.5 meters (5 feet) long and is 10 centimeters (4 inches) wide. Similar to the small intestine, it has main 3 sections: cecum, colon, and rectum. Its job is to absorb water from food into the body. The left over waste (stool) that the body can't use will be pushed out of the body (bowel movement).

Part 2: Food Absorption

HYDROCHLORIC ACID (HCL)

- The parietal cells of the stomach produce HCl and secrete it primarily in response to ingested protein or fat.
- Aids out the immune system: Hydrochloric acid is secreted to help protect the stomach from germ invaders that might be present in foods.
- It is quite powerful and could easily burn your outside skin but the stomach is lined with mucus to make sure that doesn't happen.

ENZYMES

- Enzymes are chemical substances, mostly proteins, that act as catalysts to bring about a specific chemical reaction, in this case allowing for digestive processes to occur optimally and efficiently. There are many enzymes in the body that aid the body from digesting foods, to brain activity and detoxification (all released by different glands and organs). They are major players in controlling how our bodies will function. There are a few types.

1) **Digestive enzymes:** breakdown food into smaller pieces to allow for absorption. There are 3 main categories: Amylase breaks down carbohydrates, pepsin (proteolytic) breaks down proteins, and lipase breaks down fats.

- **Mouth:** This is where the break down of food will initially occur. Chewing your foods thoroughly sets the stage for optimally digestion.

- The enzyme amylase, found in saliva, will begin the break down of starch. This is a quick and simple breakdown.
- **Stomach:** There are 2 important enzymes in the stomach that assist hydrochloric acid: Gastric amylase and pepsin. The amylase will continue to break down starch foods (converting them into glucose) and pepsin will break down protein (converting them into amino acids).



Interesting. "Stomato" refers to the mouth and "Gastro" refers to the stomach.

- **Small intestine:** The pancreas will release the bulk of 3 classes of enzymes to further breakdown carbohydrates, proteins and fats and digestion of foods. Lipase will be secreted to break down fats.
- 2) **Metabolic enzymes:** These enzymes allow for almost every biochemical reaction in the body. They repair every cell in the body, aid in detoxification and give an overall maintenance to our cells.
- 3) **Food enzymes:** These are the enzymes that food will provide us when we eat them. We get most of our food enzymes from eating raw foods - another good reason to eat more raw fruits and vegetables.

PROBIOTICS

- The digestive system contains 75% of the immune system. There are good and bad bacteria in the gut, and they have important roles in the immune system. The good bacteria keep the bad bacteria in balance. Stress, allergies, poor eating habits and antibiotic use may decrease the good bacteria levels. Below are just a few probiotic benefits:
 - boosts the immune system (helps with eczema and allergies)
 - improves vitamin and mineral absorption
 - aids in most digestive ailments (lactose intolerance, constipation, diarrhea or irritable bowel syndrome)
 - aids in manufacturing B vitamins and vitamin K
 - protects the mucous lining of the intestines
- **Lactobacillus** and **bifidobacterium** are the 2 probiotics you may be familiar with and are in most probiotic formulas. You may also be able to obtain your probiotics from foods like kefir, yogurt and miso.



What part of the digestive tract was named after a famous psychologist of the 1800s? Sigmoid Freud