

Digestion of food

How, what and why of human
digestion

What is digestion?

- Our bodies
 - break food down into smallest pieces
 - Why?
 - To be able to extract
 - the vitamins minerals, phytochemicals, fiber
 - protein, fat, carbohydrates
- That we need to keep us healthy

Purpose of digestion

Extracted nutrients and substances from foods we consume provide body with:

- Energy

- Materials for growth

- Materials for body repair

- Materials for body maintenance

Digestion involves these organs of the gastrointestinal tract

- Food is swallowed and moves through the gastrointestinal tract (GI tract).
- GI tract consists of the:
 - Mouth
 - Esophagus
 - Stomach
 - Small Intestines
 - Large Intestines

Roles of gastrointestinal tract

- Roles of the gastrointestinal tract are to:
 - Break down food into smallest pieces to release nutrients
 - Absorb nutrients into bloodstream
 - Kills microorganisms hitching a ride on food
 - Transport fiber to large intestines to improve colon health

Accessory organs help GI tract in digestion:

- Accessory organs help in digestion
- Food does not move through accessory organs
- Accessory organs aid in digestion (see below)
 - **Pancreas** releases pancreatic juice (breaks down carbohydrates)
 - **Liver** produces bile (bile emulsifies fats)
 - **Gallbladder** stores bile that gets squirted out as fats move through the digestive tract

Follow food through the digestive process

Digestion starts with thinking about, looking at or smelling a food:

Which releases digestive enzymes in our mouth even before you take a bite of the food

Food through the digestive tract

When food enters your mouth, digestion continues with chewing of the food:

- Teeth: 32 small hard living organs
 - for cutting and grinding food into small pieces
- Tongue: organ made up of muscles
 - Taste buds send taste information to brain
 - Helps push food toward back of throat
- Salivary Glands: 3 sets in mouth
 - Produce saliva, moistens food, lubricates food

Food through the digestive process

- As food gets chewed up in mouth, the mass of food in mouth now called food bolus
- Humans have swallowing reflex (involuntary)
 - when food is pushed to back of throat we reflexively swallow the food

Food through digestive process

- Food bolus is swallowed and moves into the esophagus
- In esophagus,
 - muscular contractions called peristalsis
 - pushes bolus down esophagus toward stomach
- If stand on head, does food still move down esophagus?

Food through the digestive process

- Bottom of esophagus is a sphincter called lower esophageal sphincter
 - Circular muscle that opens and closes
- Sphincter has 2 functions:
 - Regulate amount of food bolus that moves from esophagus into stomach
 - Prevent backflow of contents from stomach back into esophagus

Food through digestive process

- Food bolus passes through Lower Esophageal Sphincter and enters stomach
- Stomach is a muscular sac
- Size of 2 fists placed together

Food through digestive process

- For several hours, food bolus mixed & churned in stomach along with
 - Hydrochloric acid
 - Enzymes
 - Mucus to protect lining of stomach from the hydrochloric acid

Food through digestive process

- Hydrochloric Acid in stomach kills pathogenic bacteria naturally found in food
 - Pathogenic = disease causing
- Mucus
 - Lines stomach so Hydrochloric acid does not eat it away

Food through the digestive process

- If you overeat stomach will stretch but makes mixing and churning difficult leading to feelings of discomfort.

Food through digestive process

- Stomach mixes and churns food for several hours turning food bolus into a thick liquid called chyme.
- Now food ready to leave the stomach and move into the small intestines.

Food through digestive process

- At end of stomach is sphincter called pyloric sphincter
 - Sphincter
 - opens to allow chyme to enter small intestine
 - closes so contents of small intestine won't flow back into stomach

Food through digestive process

Sphincter

allows only small amount of chyme to enter small intestine at one time.

Will take 1-2 hours for stomach to empty into the small intestines.

Food through digestive process

- Chyme enters the Small Intestine
 - where majority of digestion and absorption takes place.
- Digestion = breaking down foods you eat into smallest pieces
- Absorption = absorbing nutrients through walls of small intestine into bloodstream

Food through digestive process

- Small intestines
 - Small intestines are about 20 feet long.

Food through digestive process

- Small intestines contain
 - folds on the inner surface of the small intestines
 - folds contain villi
- The folds and villi increase surface area of small intestines exposed to chyme.

Food through digestive process

- Small intestine
 - Enzymes break down chyme even further
 - Now nutrients small enough to be absorbed into bloodstream
 - Nutrients absorbed into the bloodstream by moving through (being absorbed through) walls of small intestines

Food through digestive process

- These nutrients absorbed through walls of small intestines:
 - Vitamins
 - Minerals
 - Proteins
 - Fats
 - Carbohydrates

Food through digestive process

- What moves onto large intestines?
- Whatever is too big to be absorbed through the walls of the small intestine.
 - Humans lack the enzymes to break fiber down in the small intestines so fiber is too large to be absorbed through walls of small intestines

Food through digestive process

- What moves onto large intestine?
- Any non nutritive substance (called waste) that you ate will move onto the large intestines.
- For example, if you accidentally swallowed an apple seed, it would move onto the large intestines. An apple seed does not contain nutrients.

Food through digestive process

- Fiber will move into the large intestines to be digested there.
- Fiber moves out of small intestine through a sphincter at the bottom of the small intestine called ileocecal sphincter and into the large intestines.

Food through digestive process

- Fiber
 - Moves into the large intestine
 - There it will be digested by bacteria
 - This is beneficial for the health of the large intestines.

Food through digestive process

- The large intestines contain billions of bacteria
 - Some bacteria promote health
 - Some bacteria are disease causing
 - Some are neutral
 - In healthy person, all bacteria live in harmony together

Food through digestive process

- Functions of Large Intestine:
 - Absorption of water
 - Breakdown of fiber
 - Bacteria in large intestines helps produce vitamin K and biotin
 - Formation and storage of fecal material from the waste material

Food through digestive process

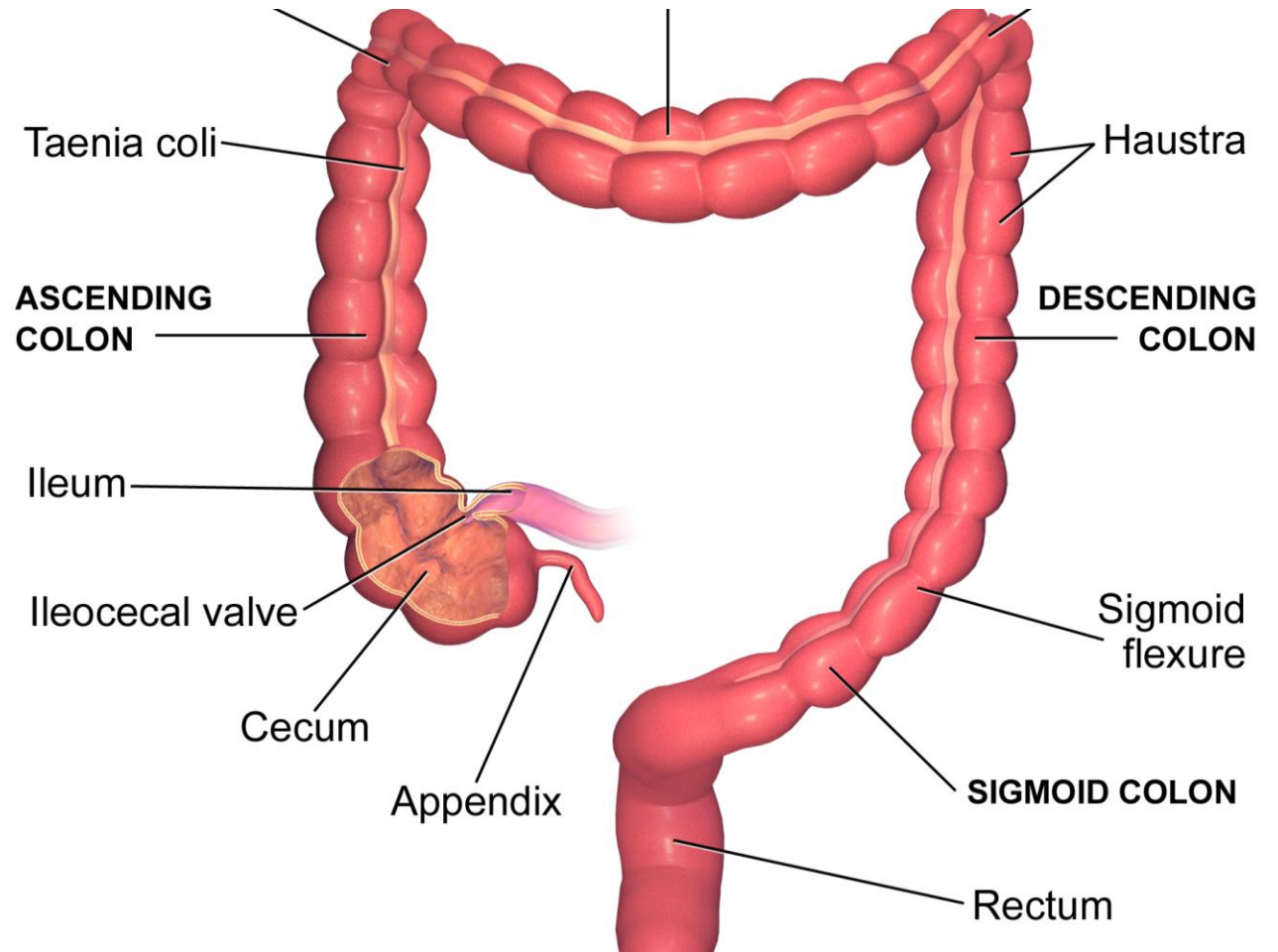
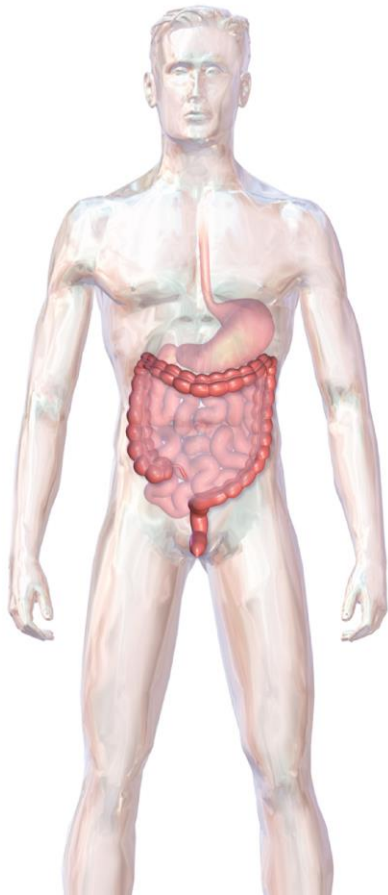
Parts of the Large Intestines:

Colon

– Ascending, Transverse, Descending

Rectum

Large Intestines



Food through digestive process

- Digested material passes through ascending, transverse and descending colon
 - in 12 to 70 hours depending on age, health, diet, fiber intake
- Colon absorbs the water from the waste material
- Now it is feces
- Feces is stored in rectum
- When feces distends rectum, stimulates defecation reflex.

Food through digestive process

- Feces pushed from rectum into anus via internal anal sphincter which is involuntary.
Next feces moves through external anal sphincter – this one is voluntary, out of anus in the final step of digestion.

Common Digestive Disorders

Gastroesophageal Reflux Disease

Pyloric Sphincter located at end of esophagus leading into stomach does not close fully

This allows hydrochloric acid from stomach to splash back up into the esophagus

-leads to burning and pain in chest

Common Digestive Disorders

- Ulcers (open sores)
 - Gastric Ulcer in the lining of the stomach
 - Duodenal Ulcer in lining of small intestine
 - Ulcers cause stomach pain, nausea, fullness, bloating, belching

Common Digestive Disorders

- Gallstones in the Gallbladder
 - Gallstones: small, hard, crystalline structures
 - No pain depending upon location
 - May require surgery to remove gallbladder, or shock wave therapy to break up stones

Common Digestive Disorders

- Disorders of the intestines:
 - Flatulence: release of intestinal gas from the rectum
 - Constipation and diarrhea
 - Constipation often due to insufficient fiber or water intake, stress or inactivity
 - Diarrhea causes loss of fluids and electrolytes; serious if lasting for extended period

Common Digestive Disorders

- Hemorrhoids
 - Swollen and inflamed veins in the rectum and anus that cause discomfort and bleeding.

Common Digestive Disorders

- Irritable Bowel Syndrome:
 - Changing bowel habits of alternating constipation and diarrhea
 - Stress plays a role
 - Food allergies plays a role

Common Digestive Disorders

– Celiac disease:

- Inability to digest wheat gluten
- Eating gluten results in flattened villi in the small intestines

Common Digestive Disorders

Inflammatory Bowel Diseases:

- Crohn's disease
 - inflammation anywhere from mouth to anus
 - Bloody diarrhea, loss of weight, pain, anemia, fatigue
- Ulcerative Colitis:
 - Lining of colon becomes irritated, swollen, open wounds.
 - Bloody diarrhea, loss of weight, pain, anemia, fatigue

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