Digestive System

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Digestive Sysytem

The **digestive system**, or **alimentary system** (systema digestorium) is a complex of organs which provides **mechanical and chemical** treatment of food, **absorption** of the treated nutrients, and **excretion** of undigested remnants of the food.

- Organs of the digestive system are either part of the **gastrointestinal tract (alimentary canal)** or **accessory digestive organs**.

- **The GI tract** includes the **mouth**, **pharynx**, **esophagus**, **stomach** and **intestines (small/ large)**, it is considered to be part of the outside of the body because the mouth and anus both open to the outer environment.

- **The accessory organs** include the **teeth**, **tongue**, **salivary glands**, **pancreas**, **gall bladder** and **liver**. These organs assist in the digestion of food.

Functions of the digestive system

- **Function**: **physically and chemically breakdown food products** (carbohydrates, protein,lipid) so that they **can be absorbed and transported to cells**.

- **Ingestion**
- **Propulsion**
- **Mechanical digestion**
- **Chemical digestion**
- **Absorption**
- **Defecation**

How does “Digestion” occur?

6 step process:

1. **Ingestion-** brining food into the mouth (**eating**)

2. **Propulsion- Peristalsis** – alternate waves of muscular contraction and relaxation in the primary digestive organs. The **end result is to squeeze food from one part of the system to the next**.

3. **Mechanical Digestion**

   - **physical preparation** of food for digestion (physical change of the food particles from large to small, this helps to **increase the surface area** to make chemical digestion more effective)

   - Actions include **chewing**, **churning** of food in stomach, and **mixing** food with digestive juices (segmentation)

4. **Chemical Digestion-**chemical change of the food particles, **bonds are broken** to change a large molecule into a smaller one so absorption can happen more effectively. This involves the use of **enzymes, hydrochloric acid, and other digestive juices**.

   - Carbohydrates, Lipid, and Proteins are broken down by enzymes.

5. **Absorption**

   - **transfer** of the digested portion of **food into the blood from the digestive canal.**

6. **Defecation**

   - **removal/elimination of the waste products(feces)** from the body.

- **<u>The mouth and associated Organs-</u>** the mouth is primarily used for mechanical digestion.

Mouth- **oral cavity;** its opening is the oral orifice, and it is the site of ingestion. It has two part; vestibule (space between cheek and teeth) and the oral cavity proper (space internal to the teeth)

Cheeks- form the lateral walls, made up primarily by the buccinator muscle, they help to keep food within oral cavity.

Lips- protect the anterior opening. The labial frenulum connects the lips to the gums.

Oral Cavity

- Superior to the ORAL CAVITY is the HARD PALATE (forms the anterior roof)composed of the MAXILLARY and PALATINE bones.
- Posterior to the hard palate is the SOFT PALATE(forms the posterior roof). This is muscular tissue that is moved during swallowing.
- Hanging from the soft palate is a conical structure called the UVULA.
- Superior and posterior to the oral cavity are the INTERNAL NARES (choanae, connection beetween nasal cavity and pharynx).
- From the internal nares, if we go anteriorly we will find the nasal cavity
- Connection between oral cavity and pharynx….ISTHMUS FAUCES!!!

- **Tongue**- composed of skeletal muscle

- It repositions food during chewing and shapes it into a bolus. Also helps to shape sounds when one is speaking.

- Contains taste buds (Taste sensation; sweet, sour, bitter, and salty)

- The tongue is attached to the floor of the mouth by the lingual frenulum which prevents posterior movement of the tongue.

- The tongue also contains lingual tonsils (lymphatic tissue).

- **<u>Salivary glands</u>**- The purpose of saliva is
    - to moisten,
    - begin the digestion of starch,
    - neutralize acids,
    - stimulate growth of beneficial bacteria in the mouth
    - dissolve food chemicals so we can taste them (stimulate the chemoreceptors of the mouth).

- Salivary glands include the parotid, submandibular, and sublingual.

✓ The parotid, submandibular, sublingual glands are EXOCRINE GLANDS. <u>Exocrine glands</u> empty via a duct to a specific location. (The other type of gland is an ENDOCRINE GLAND that empties directly into the bloodstream.)

- **Teeth**- tear, chop and grind food for swallowing.
- Mechanical digestion
- The first set of teeth humans develop is the deciduous (20 milk teeth) and then the permanent teeth (32 teeth).
- INCISORS
- CANINES
- PREMOLARS
- MOLARS

- 20 milk teeth….. formulation 2,1,2
- 32 teeth……formulation 2,1,2,3

The pharynx

- Common passageway for food, liquids, and air
- Pharyngeal muscles assist in swallowing

1. OROPHARYNX
2. NASOPHARYNX
3. LARYNGOPHARYNX

Swallowing

- Is a reflex.
- When the mouth closes, the soft palate is pushed superiorly and closes the nasal passages
- The glottis closes and respiration stops. The glottis also bends and closes the entrance into the larynx.
- The esophagus is opened by pressure of the food. This allows the epiglottis to open.
- Food then enters the esophagus.

Esophagus- long muscular tube that moves food through peristalsis. The lumen is typically collapsed.

- It extends from the laryngopharyx, through the thorax, exits via the esophageal hiatus (diaphgram), and meets the stomach at the cardiac orifice. The cardiac sphincter controls the entering and exiting of substances into/ out of the stomach.

- The upper part of the esophagus contains skeletal muscle and the rest contains smooth muscle. The esophagus contains an adventitia layer not a serosa layer.

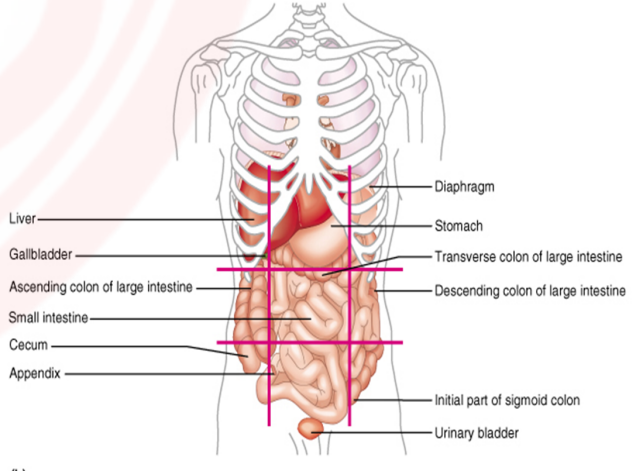
- Once food is swallowed, smooth muscle in the esophagus carries the bolus by PERISTALSIS**.**

- Once food enters the esophagus**, peristalsis is automatic**.

- The bolus enters the stomach by passing through the GASTROESOPHAGEAL SPHINCTER. It is held shut by contraction of muscle.

Abdominal Quadrants and regions

- The abdominal wall is divided into regions for descriptive purposes
  - Four quadrants divided by transumblical line and median vertical line
  - Nine regions divided by transclavicular lines (vertical), subcostal line (passes between the costal cartilages of 10th ribs) and interspinous line (passes between the anterior superior iliac spines)
    - Right and left hypochondriac, epigastric
    - Right and left lumbar, umblical
    - Right and left inguinal, hypogastric



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Anatomy of the digestive System-

- **The peritoneal cavity and peritoneum-** The **peritoneum** is an extensive **serous membrane** in the abdominal cavity
- **The visceral peritoneum** covers the surfaces of digestive organs.
- **The parietal peritoneum** lines the wall of the abdominal cavity.
- **The peritoneal cavity** is found in between the visceral and parietal peritoneum and filled with serous fluid.
- A double layer of peritoneum that hold digestive organs in place is called the **mesentery**.

➢ **Mesenteries** connect digestive organs to the dorsal and ventral abdominal walls. Sometimes they are referred to as ligaments. Dorsal Mesenteries form;

1) Greater omentum- from the greater curvature, It also holds a lot of fat, Abdominal policeman! Lesser omentum?
2) Mesentery proper- support and hold the jejunum and ileum.
3) Transverse mesocolon- attaches the transverse colon to posterior wall, it fuses with the greater omentum.
4) Sigmoid mesocolon- connects sigmoid colon to posterior pelvic wall.

- Organs surrounded by mesentery and suspended in the cavity are called **intraperitoneal or peritoneal organs**. Some are not surrounded by mesentery; they are called **retroperitoneal**

  - **<u>Intraperitoneal organs (has mesenterium);</u>** stomach, jejenum, ileum, caecum, transvers colon, sigmoid colon, splen
  - **<u>Reroperitonel organs;</u>** kidneys, pancreas, abdominal aorta, inferior vena cava

- F. **Stomach**- A pouch with sphincter muscles at both ends: superiorly is the **cardiac sphincter** and inferiorly is the **pyloric sphincter**.

- Gross anatomy- It is inferior to the diaphragm and anterior to spleen and pancreas

- The stomach is generally J shaped and has the following features: **cardiac sphincter, cardiac region, fundus, body, pyloric antrum, pyloric canal, and pyloric sphincter.**

- The curves of the stomach are described as the **greater and lesser curvature.**

- Internally large folds called rugae are visible.

- The **LESSER CURVATURE** of the stomach is anchored to the liver with the **LESSER OMENTUM**. It cannot move.
- The esophagus and duodenal ends are anchored. As food fills the stomach, it can sag on the left side.
- It has three layers of smooth muscle: longitudinal layer, circular layer, and oblique layer.
- These muscles do not contract together-they contract out of synchronization. This enables the muscles to mix and churn the food in the body of the stomach.
- The mixing is with water, hydrochloric acid (produced in the stomach), and pepsin. This mixture is known as CHYME.
- The release of the chyme is regulated by the pyloric sphincter.
- It has Rugae**!**

- G. **Small intestine**- this is the longest section, an area where chemical digestion is completed (where most digestion occurs) and most nutrients are absorbed (%74).
- Food remains here for about 3-6 hours.
- The small intestine can be divided into three section: **duodenum**, **ilelium**, **jejunum**.
- It uses peristalsis to move chyme along and for segmentation movements.

Gross anatomy- the tube runs from the pyloric sphincter of the stomach to the beginning of the large intestine.

The first division is the duodenum (5%) short area where the digestive chemicals from the pancreas and gall bladder are received.

The second division is the jejunum (40%) a longer region where food is digested and nutrients are absorbed.

The last section is the ileum (60%) it connects to the large intestine.

Large intestine- Area where food remains for 12-24 hours. Some absorption and digestion occurs (by bacteria) it is primarily designed to reabsorb water and electrolytes.

- Gross anatomy- It is wider than the small intestine but shorter.It is divided into;

✓ The cecum (opening of ileum to large intestine, has iliocecal valve and the vermiform appendix (opens to the cecum, contains lymphoid tissue)),
✓ The colon (has at least four sections; ascending, transverse, descending, sigmoid),
✓ The rectum (has rectal valves that prevent feces from being passed along with gas)
✓ The anal canal (external to abdominal pelvic cavity, has external anal canal).
✓ The final sphincter in the tract is the SPHINCTER ANI.
✓ The sigmoid and rectum are retroperitoneal.

- The ileocecal valve (sphincter) regulates flow into to large intestine. It also prevents backflow from the large intestine into the small intestine. (Transition between small and large intestine!)

- The sections of the colon and bends are: ascending colon(retroperitoneal), right colic (hepatic) flexure, transverse colon, left colic (splenic) flexure, descending colon(retroperitoneal), and sigmoid colon

- Some of the feature are:
  the teniae coli (longitudincal strips that run along the colon),
  the haustra (pockets or sacs)
  the epiploic appendages (hanging fat filled pouches)

- The sphincter ani is an involuntary smooth muscle.
- The DEFECATION REFLEX which is kept in control by the sigmoid flexure and peristaltic activity.
- When peristalsis occurs the sphincter ani relaxes. An EXTERNAL SPHINCTER (skeletal muscle) can oppose the sphincter ani. This allows you to “hold it in” until you find a bathroom!

- The first part and part of the second third of the esophagus are also made of skeletal muscle. The rest of the GI tract is smooth muscle.

The rectum

- Last portion of the digestive tract
- Terminates at the **anal canal**
- **Internal and external anal sphincters**

- **Liver**- considered the largest gland.
- It performs lost of functions that influence several systems beside the digestive system.
- In regards to the digestive system it produces bile. A substance that emulsifies fat and makes it accessible to fat digesting enzymes.
- The liver is involved in balancing blood glucose levels, it responds to hormones, and clears toxins or drugs from the blood(detoxification) and makes blood proteins.

Gross anatomy- It is protected by the rib cage.

- It has a diaphragmatic surface and a visceral surface, the bare area is fused to the diaphragm.
- Its lobes: right and left lobes that are divided by the falciform ligament, the caudate lobe, and the quadrate lobe.
- The posterior and inferior view also shows the round ligament (ligamentum teres) and the ligamentum venosum.
- The porta hepatis is also on this side. Major blood vessels, nerves, and ducts enter through the porta hepatis.

- **Gall bladder**- pear-shaped muscular sac that stores, modifies and concentrates bile, it is attached to the cystic duct and when the muscle contract bile exits through this duct and into the common hepatic duct.

- Bile is carried from the liver by the right and left hepatic ducts that merge into the common hepatic duct that also connects to the cystic duct of the gall bladder. Bile reaches the small intestine through the common bile duct (common hepatic duct+ cystic duct).

- **Pancreas**- a gland that is both exocrine (has a duct) and endocrine (releases hormones into the blood stream). It joins gall bladder secretions and both enter the duodenum via the hepatopancreatic ampulla at the major duodenal papilla (pancreatic duct penetrates duodenal wall). The head of the pancreas is embraced by C-shaped curve of the duodenum.

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