

Large intestine

فقر انزيمات في دالة صامت الي تسمى digestion (اي ما صار اليه / اصف عليه).
ذلك البكتيريا الموصوفة قشر انزيمات الة تسمى digestion أو actions معينة.
By: Safa Abdul Ghani

مدين صفا absorption ل (1.5 L) م Water

(اصحاحنا absorption ل 7 لتر م ال Water في small intestine)

وهذه سوف تدر حالة ال Stone

↑↑ absorption in water

↓
Constipation

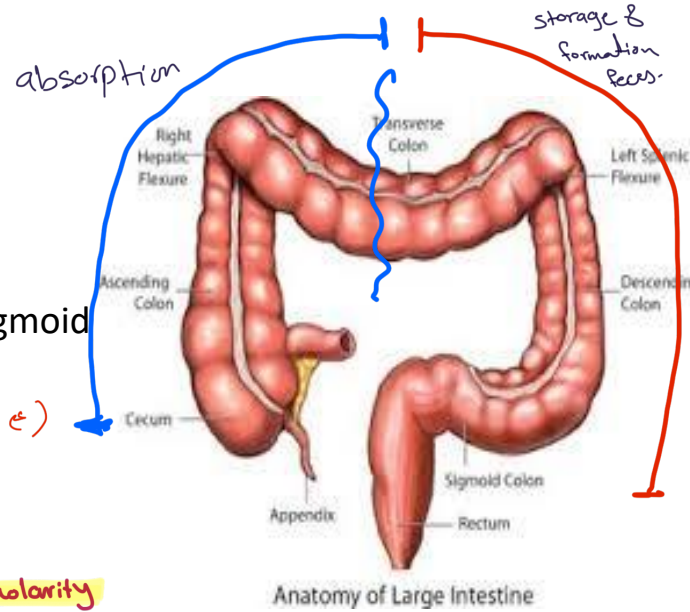
↓ absorption

↓
watery diarrhea.

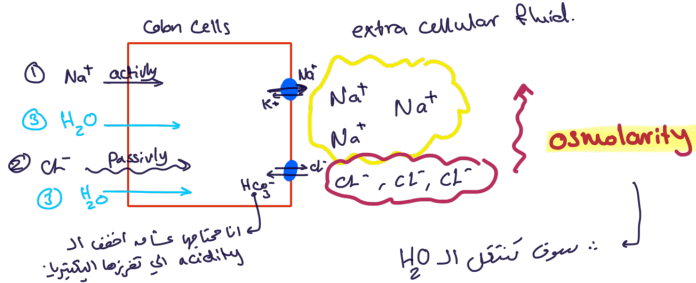
The Colon

Made up of the:

- Caecum
- Colon - ascending, transverse, descending and sigmoid
- Rectum
- Anal canal



absorption of water :- (مع صدى اى اى)



المعظم في الكمية الي حبيبه الها absorpt
لد Na^+ هو aldosterone

الذي غير ال (tight junction) هو وجود tightly junction بين الخلايا في ال colon الي يرفع مايقدر تاني ي ال (osmolarity) وهذا الاضغ عناه لسي كملو كيرة به H_2O وكذلك الميا الي بتتجمع حابترجع.

no - villi

Intestinal Phase:

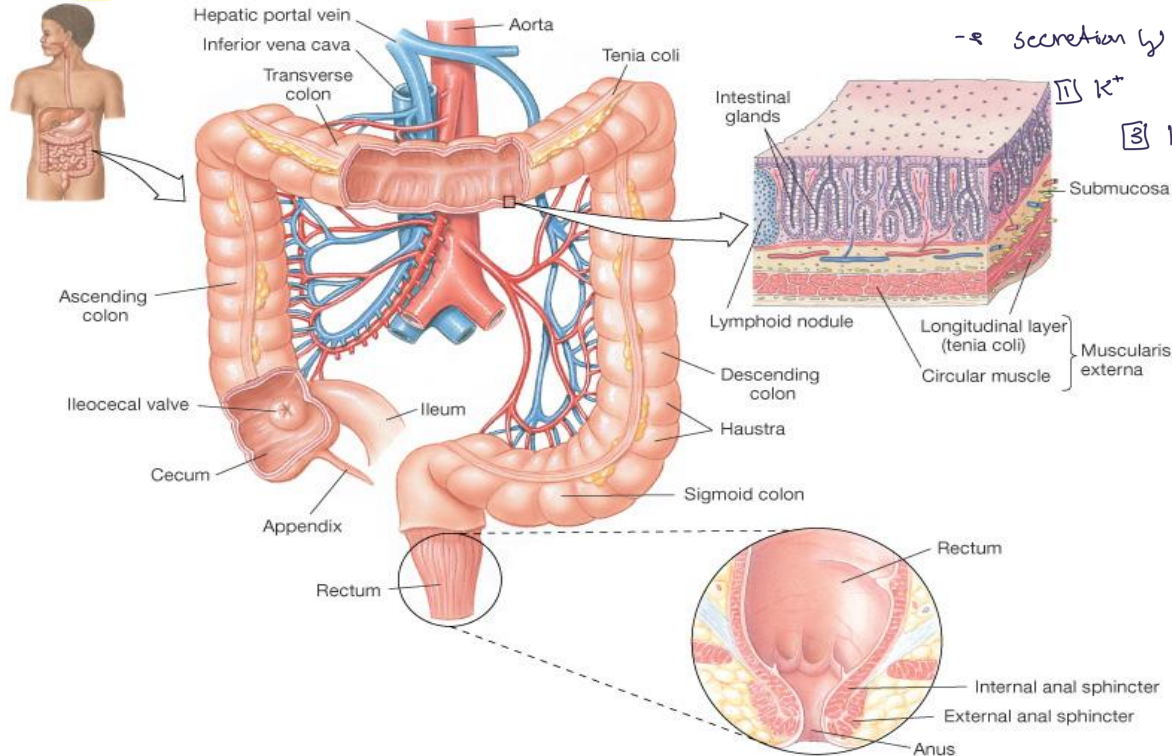
Large Intestine, H₂O Absorption & Defecation

- $\rightarrow$ absorption $\rightarrow$ $\leftarrow$

- 1 H₂O 2 Ions $\leftarrow$ Na⁺ Cl⁻ 3 some vitamins

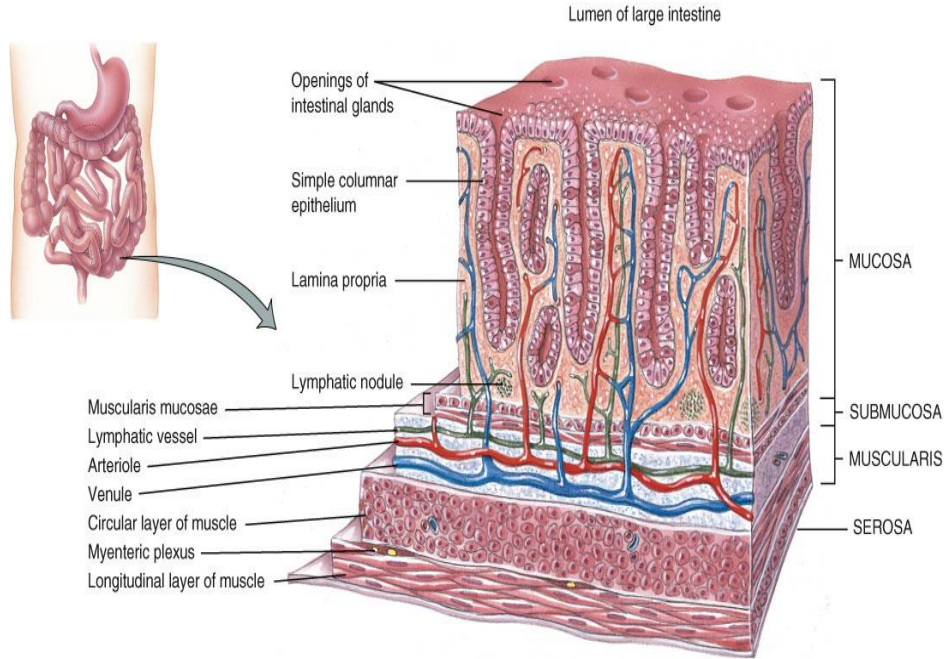
- $\rightarrow$ secretion by the system $\leftarrow$

- 1 K⁺ 2 mucus
3 HCO₃⁻



LARGE INTESTINE HISTOLOGY

- Simple columnar mucosa
- Deep crypts with intestinal glands
- **Crypts of Lieberkuhn** secrete lots of mucus rich with bicarbonate (active transport)
- **Lubrication**. Protection from bacteria, protect from acids produced by bacteria
- **No villi**



(a) Three-dimensional view of layers of the large intestine

Intestinal Phase:

Large Intestine, H₂O Absorption & Defecation

- (Small Intestine Reabsorbs ≈ 7.5 L/day of water)
- Large Intestine Reabsorbs ≈ 1.4 L/day
- Absorption mainly in **proximal part**
water ~ 0.4 - 1.4 L/day
Na⁺ : Active absorption followed by passive absorption for Cl⁻ and water
Cl⁻ : Passive transport in proximal part (following Na⁺)
Passive transport in distal part (shifted with HCO₃⁻ secretion)

Stimulation of secretions and motility

- Tactile stimuli (direct contact of the chyme with mucosal cells)
- Local nervous reflexes to mucus cells in crypts of Lieberkuhn
- Stimulation of pelvic nervous (parasympathetic) * الأعصاب في المنطقة التي تسمى Small intestine آكل من Large intestine
- Emotional disturbances causing extreme parasympathetic stimulation

لم يذره قسوة أو defecation حثا حثا

emotion & Life style $\rightarrow$ تقلل منها $\rightarrow$ تتحكم فيها كثير (bowel movement) حركة أو لون $\leftarrow$

↓
ex: stress

المرضية 6 طبيعية الأكل (Fiber هدمها).

Absorption in the large intestine

⑥ اُدلة جزئية Large intestine (Proximal part) اِدْ-بَعِيْل خِيَا
absorption اِسْعَا absorbing colon

- Each day 1.5L of chyme passes through the ileocaecal valve into the colon
- Most of the water and electrolytes remaining in the chyme are absorbed in the colon and less than 100mls of fluid is excreted in the faeces
- **Most of the absorption in the large intestine occurs in the PROXIMAL half - called the absorbing colon**

- Absorption occurs through the absorption of sodium which pulls chloride with it via the electrochemical gradient

- The **tight junctions** in the colon are very tight and prevents any back diffusion of Na ions from the paracellular space into the colon

- This means it absorbed Na better than the small intestine and the reduced back diffusion means the concentration of sodium in the paracellular spaces increases → increases the concentration gradient

- **Creates an big osmotic gradient** which increases absorption of water

- Also has a **bicarbonate/chloride pump** like the small intestine
- This bicarbonate helps to neutralise bacterial acidic products

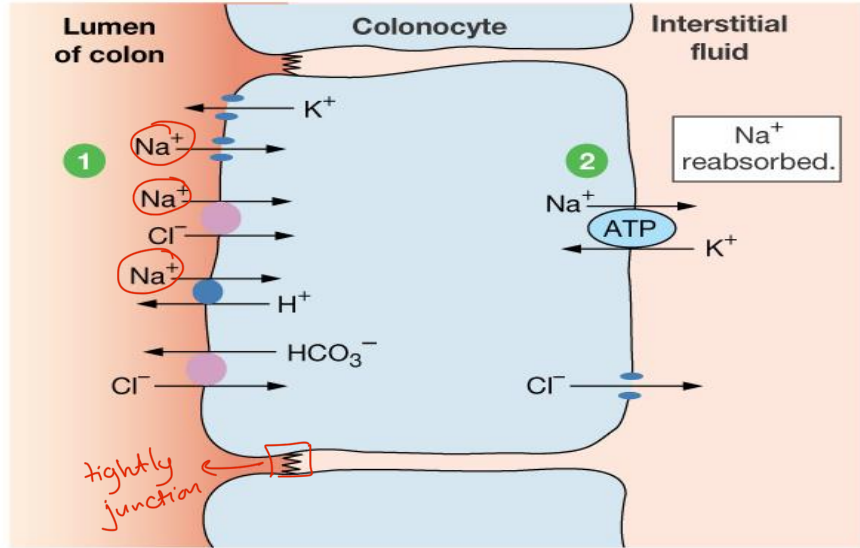
- The **distal ends** of the colon are used mainly for faeces storage until an appropriate time - called the **storage colon**

اِسْعَا كَلْ مَا صَار اِكْتَر لَدْ فِيس feces كَلْ مَا صَار كِبَام لَلِيَا اِكْتَر
Storage كَلْ مَا صَار اِكْتَر
Constipation كَلْ مَا صَار

عَسَا كَلْ
بِصْر كَلْ

Intestinal Phase: Large Intestine Digestion & Absorption

- NaCl enter colonic mucosa by multiple pathways
- K^+ is secreted
- Na^+ absorption, K^+ secretion regulated by aldosterone

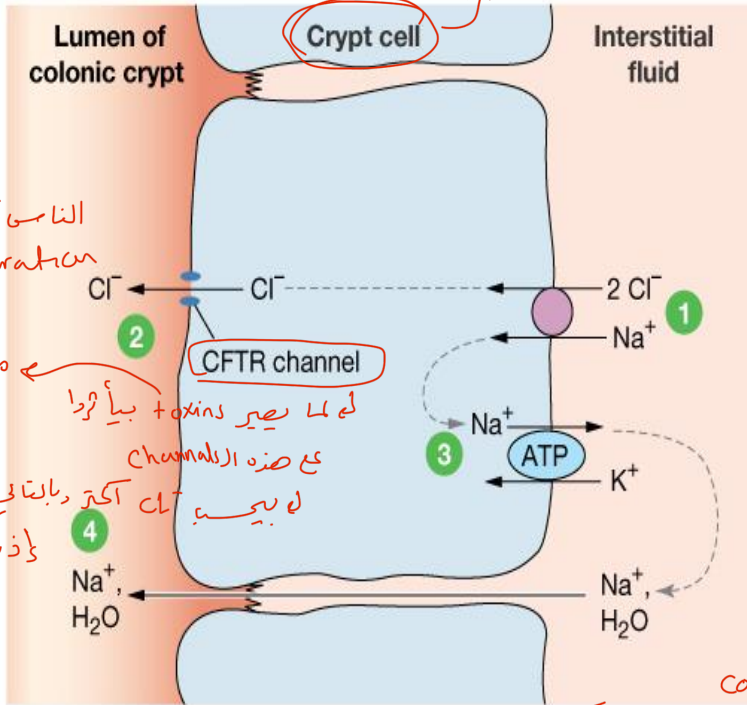


1 Na^+ enters colonic cells by multiple pathways.

2 The Na^+ - K^+ -ATPase pumps Na^+ into the ECF.

Intestinal Phase:

secretion Cl^- & mucus وظيفتها / تنز



1 Na^+ and Cl^- enter by cotransport.

2 Cl^- enters lumen through CFTR channel.

3 Na^+ is reabsorbed.

4 Negative Cl^- in lumen attracts Na^+ by paracellular pathway. Water follows.

الناس كانت اتكون من dehydration

مثل ال Colera

لما يصير toxins + بيأفردا مع هذه القنوات

لما يصير Cl^- أكثر دابنا في بسبب H_2O أكثر

لذا يدر diarhea

* من حصة كبيرة لو عملت ازالة ل colon

لانه سخله بيخو عن ال kidney من شها أكثر

Bacteria in the colon

→ لازم تكون في ring
مسير (ص. مجلدي)

→ لان شوكسي
لوزاد عروها
أو قل .

- Colon contains bacteria - especially **COLON BACILLI**
- Present in the **absorbing colon**

- Used to **digest small amounts of cellulose** (صعب يتم عمل digest لافضل الحجم)
- used to form **vitamin K** - this is important as the amount ingested in foods is normally not enough to have normal coagulation
- used to make vitamin **B12** and **thiamine** →

ص. حكت
الاستقارة

see. Primary ←
Bile ← لتعمل ال
acid. Bile acid

- As the bacteria work they create gases - carbon dioxide, hydrogen and methane
 - Causes odour

Faeces

محتواه يمتد
على وضع الجسم

- Faeces releases it make up of water and solid matter ^{لوكايتو rich حطافو}
 - The solid matter is composed of dead bacteria, fat ^{الطح} inorganic matter, protein and undigested roughage, cellulose, fibers, bile acids ^(50%) and salts.
 - Undigested roughage is from the food and dried constituents of digestive juices, dead epithelial cells and bile pigment
 - The **brown colour** is due to sterobilogen
 - **PH: slightly acidic** (5-7) ^{لانه في باكتيريا في النهاية، هي تفرز الحمض} because of the bacteria, some of the acidity is buffered by bicarbonate secretions from the distal part.

Colonic movements

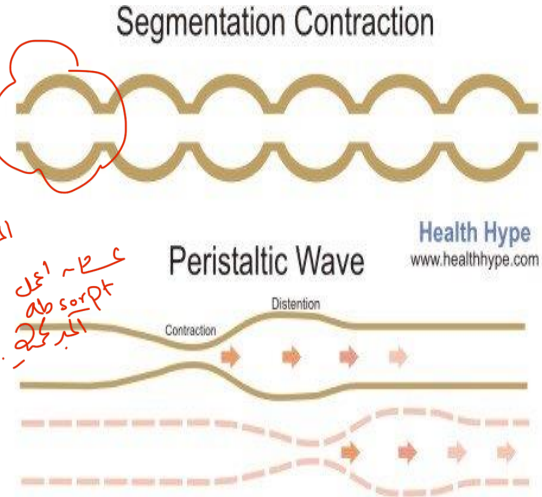
- Strong muscular peristaltic movements are not required here so the movements of the bowel wall are **slow** → defecation ← ماعدا في رتة
- There is still have mixing and propulsion movements

(segmental) ↓ الحواشي

A) Mixing movements (Haustral contraction):

- The mixing movements are *segmental like* in the small intestine → but there is contraction of **BOTH** circular muscle and longitudinal muscle here with slow wave movement (less frequent than intestine)
- This creates **haustrations** (sac formation), which give the colon its segmented appearance
- Controlled mainly by local reflexes involving intrinsic plexus

← هذا الشكل على انه
feces ← رتة
في هذه
المنطقة
عكس العمل
absorb
المبرحمة



B) Mass Movement:

- A peristaltic wave ^{كثرة كبيرة} in which the contracted segment remain contracted ^{في اتجاه واحد} for some time, essential for moving a great mass of food in one direction

• Three to four time a day ^(حسب الحاجة)

- Initiated generally after meals (gastro - colic reflex).
- Massive contraction drive colonic content into the distal portion of large intestine (where its stored for defecation)

Intestinal Phase:

Large intestine motility

- Chyme in Large intestine continues to be mixed by **segmental contraction**.
- Forward movement depends on a unique colonic contraction known as ***mass movement***.
- Colonic contraction occurs 3-4 times/day
- Colonic contraction are associated with eating & distension of the stomach (***gastrocolic reflex***)
- Defecation Reflex: Mass Movement → Rectal Distension
- → Internal Sphincter (involuntary) → External Sphincter (voluntary)

Defecation reflex

ال rectum بيكون ناضج من feces في اول ما يصل لبيبر ليضيق عليه وينقبض
تفترز locally ل myenteric plexus 8 signal of Brain ← (pelvic nerve) para sympath

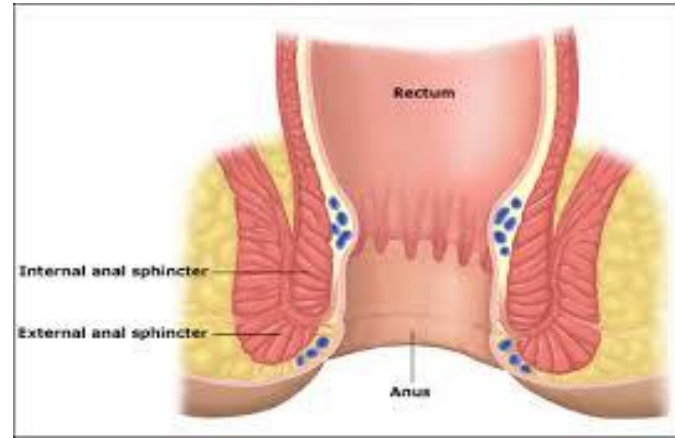
Initiated by the **defecation reflex** ↑ Peristaltic waves ← تفترزها myenteric nervous dist

- When faeces enters the rectum the distension of the rectum sends afferent impulses to the **myenteric plexus to cause peristaltic waves** through the **minimal frequency** descending, sigmoid colon and rectum → This forces the faeces into the anus
انه ليصل مرتبه في الاسبوع 6 مرة حصيل مشاك غير كدة كله طبيعي
- ② The myenteric plexus **sends inhibitory signals to the internal anal sphincter to relax it**
حيف ننت
- If ready for defecation → conscious signals relax the external anal sphincter
ل بيحبو Pudendal nerve وهادا Somatic (فيق ما عند Smooth muscle)
- The myenteric plexus is not strong enough to cause defecation on its own → so afferent impulses are sent to the spinal cord → **parasympathetic efferent signals** are sent back to the colon and rectum via the *pelvic nerves*
- The parasympathetic signals **increase the intensity of the peristaltic waves** to cause defecation. This can be so powerful the contents can be excreted from the splenic flexure down

اصحانه عند علاء ال defecation بيصير تفترز لعمدة اخراج ال urine
ال يب لا يقد ال defecation ويصير contraction بيصير ضيق ل diaphragm (contract)
ضيق ي ال bladder ← urination

Defecation

- Usually the rectum is empty of faeces
 - This is due to a sphincter that exists between the sigmoid colon and the rectum and also the shape of the rectum which increases resistance of faeces movement
 - When faeces is pushed into the rectum during a mass movement the urge to defecate is felt immediately
 - This causes contraction of the rectum and relaxation of the anal sphincters
-
- The internal anal sphincter lies at the start of the anus and is made of **circular muscle**
 - The external anal sphincter is made of **striated voluntary muscle**
 - This is innervated by the PUDENDAL nerve (part of the somatic nervous system) and is under voluntary control - usually constricted
 - These sphincters prevent the leakage of faecal material



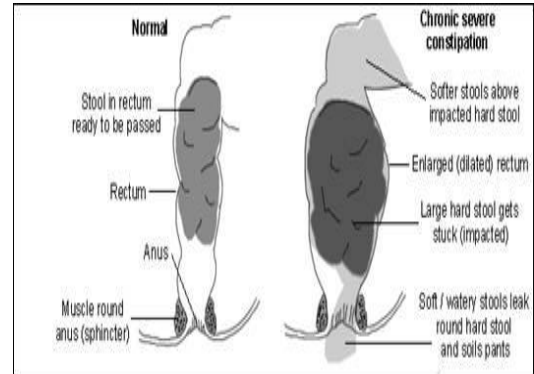
Constipation

لو هو جايه امساك → له صارت عادة
 حس كل الجداره قدي → حس كل الجداره قدي
 ان مسكويه تكونه feces → ان مسكويه تكونه feces
 لو صغر ال feces → لو صغر ال feces

Constipation ← انشأ ب الميا ← انشأ ب الميا ← انشأ ب الميا

The defecation reflex can be consciously stimulated however it is not as strong as when it arises naturally → if you inhibit your natural reflexes a lot you can = constipation

- This means slow movement of the faeces through the large intestine
- Associated with large quantities of large dry faeces due to **over absorption of fluid**
- Any diseases that obstructs the *movement* of faeces in the intestine can cause constipation - **tumours, ulcers** ← حس كل بيب → حس كل بيب
- Can occur due to **poor bowel habits** → not acknowledging defecation reflex
- Occasionally constipation is so severe that bowel habits only occur once a week
 - Large amounts of faeces build up in the colon
 - This can cause the colon to **distend by to to 8cm**
 - This can be called MEGACOLON
 - One cause is a lack of nerves in the myenteric plexus so there is no defecation reflex or peristalsis in this area of the colon



Diarrhea leads to Dehydration (4 million deaths/yr)

- A pathological state resulting in watery stool (no absorption of water)
- Intestinal secretion is not balanced by absorption.
- 2 types of diarrhea:
 - Osmotic
 - Secretory
- Osmotic diarrhea caused by substances include undigested lactose and sorbitol.
 - (sorbitol) ← نوع السكر (undigested)
↓
↑ osmolarity
absorption in H_2O ←
- Secretory diarrhea occur when bacterial toxins enhance colonic Cl^- secretion.
 - ↳ toxin

Disorders of the Colon

Diarrhea

- Is caused by the rapid movement of faeces through the large intestine

There are several causes:

- Enteritis → This is inflammation of the intestinal tract
• Usually caused by viruses or bacteria
• Where infection is present the mucosa of the intestine becomes irritated and its rate of secretions and motility increases
• This means there is a large amount of fluid to “wash away” the infection and strong contractions to push the faeces towards the anus quickly

- Psychogenic diarrhea → Due anxiety or stress (e.g. before an exam) ← Constipation diarrhea
Due to increased parasympathetic stimulation → increases secretion of mucus and motility

- Ulcerative disease → The intestine becomes very inflamed and ulcerated
Creates lots of mass movements - can now occur 10 times a day!
Increases secretion from the colon also

Immune function of the GI tract

Vomiting
diarrhea } → Productive
process.

- GIT is the largest immune organ in the body
- The first lines of defense are the enzymes & immunoglobulins of saliva
- High acid environment of the stomach
- If pathogen reach the intestines: sensory receptors and immune cells of the GALT (*gut associated lymphoid tissue*) respond
- This response: diarrhea or vomiting →

لأنه لازم نتوقفه الواسع بـ شرب مياه

بطيء
غشوة
H⁺ إفراز
→ Meta. alkalosis

Vomiting is a protective reflex

- Is a forceful expulsion of gastric and duodenal contents from the mouth
- It a protective reflex that removes toxic material from GIT before it gets absorbed.
- Coordinated through vomiting centre in the medulla.
- Stimulation can be from GIT, or chemicals from blood as drugs, pain or disturbed equilibrium.
- Efferent signals initiate a wave of reverse peristalsis moves from small intestine and moves upward.

Vomiting is a protective reflex

- The motility waves aided by abdominal contraction and relaxation of the stomach
- During vomiting respiration is inhibited (epiglottis and soft palate close) to prevent aspiration of the vomitus
- Aspiration can lead to pneumonia
- Excessive vomiting can lead to gastric acid loss and metabolic alkalosis.

Vomiting is a protective reflex

- Is a forceful expulsion of gastric and duodenal contents from the mouth
- It a protective reflex that removes toxic material from GIT before it gets absorbed.
- Coordinated through vomiting centre in the medulla.
- Stimulation can be from GIT, or chemicals from blood as drugs, pain or disturbed equilibrium.
- Efferent signals initiate a wave of **reverse peristalsis** moves from small intestine and moves upward.

Summary

Processes of Digestion:

Ingestion

Digestion

Absorption

Secretion

Motility,

Reabsorption

Defecation

Anatomy of Digestion:

**Mouth, Esophagus, Stomach, Small & Large Intestines, Rectum,
Anus (Pancreas & Liver)**

Summary

- Enzyme Hydrolysis of Carbohydrates, Proteins, Lipids and Nucleic Acids provide the Nutrients, Absorbed & Conducted to Liver for Storage and Conversion
- Regulation from CNS (Long Reflex) and ENS (Short Reflex) Integrate Hormones & Paracrines to Coordinate Digestion