

# Digestive System

University of Jordan  
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Slide  Sheet  Handout  Other

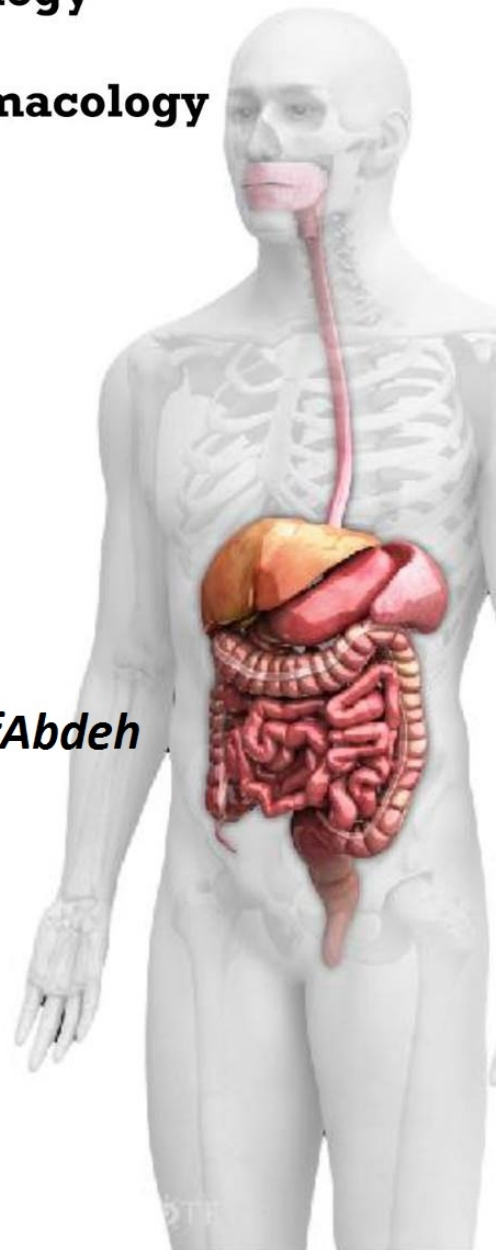
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**Sheet #: 3 (1-parasitology)**

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**Date:**

**Price:**



## **Parasites affecting The Gastro-Intestinal Tract (1)**

**"Whatever the mind of man can convince and believe, it can achieve."**

In today's lecture we're going to discuss parasites affecting the gastro-intestinal tract, mainly the protozoa and its different families: Rhizopodia, Ciliates, Flagellates & Apicomplexa.

### **Protozoa**

#### **Amoeba**

- A free living parasite inhabiting water and soil.
- They are grouped into 6 species that infect human's intestines and they are further divided into:
  - a) **Commensal**(Occasionally causing diseases)  
EntamoebaGingivalis (lives in the mouth ), Endolimax Nana, Burschlii, Fragilis, Coli.
  - b) **Pathogenic**  
EntamoebaHistolytica.

#### ✓ **EntamoebaHistolytica**

- A member of **Rhizopodia family** as they move through **pseudopodia**.
- It inhabits the large intestines where the disease is mainly caused.
- It has trophozoites:(The trophozoite form is the one that feeds, divides, moves and causes diseases, it is the vegetative form).
  - a) Their diameter ranges from 20-45 microns.
  - b) Divide asexually. (By methods of binary fission)
  - c) They cause the disease but they die outside the body so they can't transmit the disease.
  - d) Has a cytoplasm which is divided into 2 areas:

- i. Ectoplasm: A clear area found on the periphery and involved in movement & locomotion.
- ii. Endoplasm: A granular area found at the center and contains: a nucleus (has a uniform rim of chromatin around the periphery and nucleolus in the middle) and vacuoles (might contain digestive bacteria and RBCs).

Under stress conditions, the trophozoite changes into a cyst during its development, and morphological changes occur.

- a) Trophozoites shrink in size.
- b) Appearance of chromatoid bodies (cigar-shaped molecules made up of DNA & RNA).

A mature cyst has 4 nuclei and a tough outer layer so it could pass through feces in order to transmit the disease.

**Note:** The chromatoid bodies are found during the development of the cyst but they disappear when the cyst is mature.

✓ **Entamoeba Dispar:**

- It's not a real pathogen but morphologically they are identical to *Entamoeba histolytica* (cyst wise and trophozoite wise).
- There are 4 pathogenic factors related to *E. histolytica* that we can rely on to differentiate between *E. histolytica* and *E. dispar*:
  - i. **Lectin:** Helps in the attachment of *E. histolytica* trophozoite to the enterocytes.
  - ii. **Proteases:** Which are enzymes that digest and attack the enterocytes.
  - iii. **Amoeba poles:** Which are complementary molecules inserted in the wall of enterocytes causing holes.
  - iv. **Complement system:** *E. histolytica* is more resistant to complement system.

So, morphologically we can't differentiate between *E. Histolytica* and *E. Dispar*, but as *Histolytica* has the previous 4 features we can depend on them and as they are the virulence factors, generally speaking 10% of people worldwide have *Entamoeba* in their bodies but at the same time not many of them have the disease and that is due to having *Dispar* and not *Histolytica* in their GITs.

✓ **Entamoeba Coli:**

Is commonly present as it exists in 30% of people worldwide and it's not pathogenic at all. However, we as physicians need to know the differences between *E. Histolytica* & *E. Coli* in order not to misdiagnose them.

- (مشال بكتيريا E.Coli = Entamoeba Coli لذوي الاحتياجات الخاصة)

**The morphological differences are:**

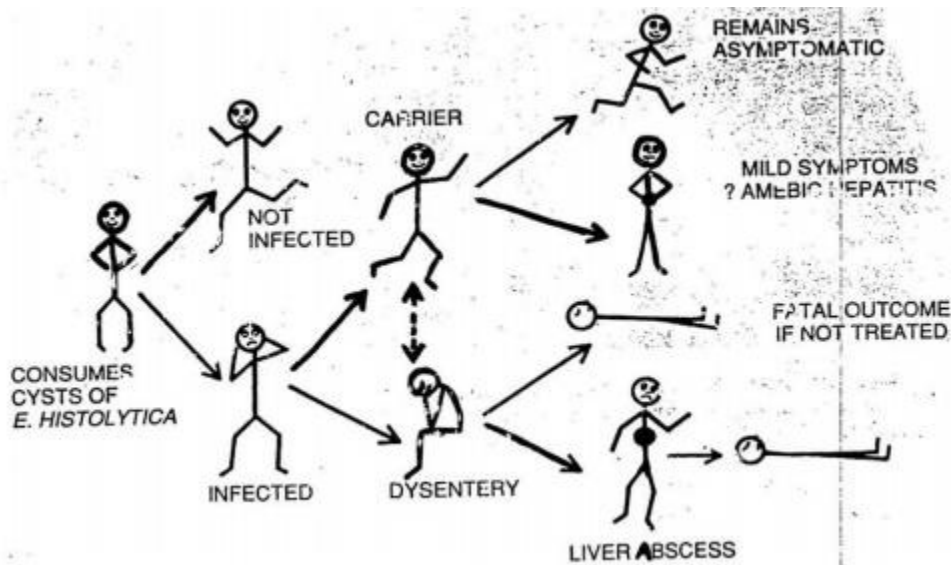
	<b><u>E.HISTOLYTICA</u></b>	<b><u>E.COLI</u></b>
<b><u>NUCLEUS</u></b>	Has a uniform rim of chromatin around the periphery & a central nucleolus.	Has a scattered and dispersed chromatin rim & a large eccentric nucleolus.
<b><u>Ectoplasm</u></b>	More prominent indicating that the movement is faster So the ectoplasm is responsible for locomotion.	Less prominent so slower kind of motion.
<b><u>Endoplasm</u></b>	<ul style="list-style-type: none"> <li>✓ Vacuoles contain mainly RBCs.</li> <li>✓ Chromatoid bodies are cigar-shaped/sausage – shaped. (during cyst maturation)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Vacuoles do not contain RBCs, they contain bacteria.</li> <li>✓ Chromatoid bodies are splinter – shaped "shattered glass". (during cyst maturation)</li> </ul>
<b><u>Pseudopodia</u></b>	Large; faster movement.	Blunted and not distinctive; slower movement.
<b><u>Cysts</u></b>	Has 4 small nuclei.	Has 8 large nuclei.

trophozoites

❖ Life cycle of E.Histolytics:

The trophozoite passes into the lumen of the large intestine "Luminal Parasite", Producing cysts and these cysts pass through feces which can contaminate food and water, then someone comes and digest this contaminated food & water and then the infection will be passed on to him. The cyst goes to the stomach (usually these cysts are resistant to acids). Then, they pass to the small intestine and under the effect of digestive juices, the cyst wall disintegrates and finally, the 4 nuclei are released and finally they will be divided into 8. Those 8 nuclei will develop into a developing amoeba called "**AMEOBOOLA**" (small amoeba), and then they will leave to the large intestine and develop into a fully grown Amoeba.

**Note:** E.Histolytica is transmitted feco-orally, directly ;meaning that it doesn't need an intermediate host.



So if somebody consumes the cysts , he may get infected or not . in people who are not infected the cysts don't give rise to amoeba in their G.I.T for unknown reasons. Infected means the presence of trophozoites of E.Histolytica in the large intestines, **which means that you might be:**

a) Symptomatic

- b) **Asymptomatic "Carrier"** i.e. they carry the amoeba and the cysts and can infect other people .
- c) These two categories can swap from a situation to another, i.e. symptomatic individuals can be cured & become asymptomatic ones (carriers) and vice versa.

❖ **Diseases& Clinical manifestations:**

The disease which is caused mainly by E.Histolytica is **Dysentery.**

Dysentery is further divided into two types:

- a) **Bacterial Dysentery aka Bacillary Dysentery** which is caused by Shigella. (more common)
- b) **Amoebic Dysentery**

❖ **Complications:**

- a) Perforation of the large intestine giving rise to peritonitis which is a fatal outcome.
- b) It can also invade the large intestine's wall, reaching the blood and getting distributed by the blood drainage to finally reach the liver causing abscess and here they are referred to as "Tissue parasites".
- c) They might also invade the lungs causing abscess there too, also other organs may be involved.

**Note:** Dysentery is manifested by a bloody diarrhea with small amounts of feces and frequent defecation (**tenesmus**) not sure about the name , but Dr. pronounced it (terismus). Mucous and pus are also in the feces in addition to its foully smell lacking fluids and occasionally accompanied with fever (50% of total cases are associated with fever)

**Note #1:** The asymptomatic carriers can experience mild gastro-intestinal symptoms like: abdominal pain and mild hepatic involvement which is known as "Amoebic hepatitis"

**Note #2:** E.Histolytica can also create some kind of granuloma on the wall of the large intestines leading to thickening of the wall and creating a mass known as "Ameoboma" and this may be confused with a tumor, it

looks like a tumor on C.T scan , so you have to do further tests as it may be an ameoboma.

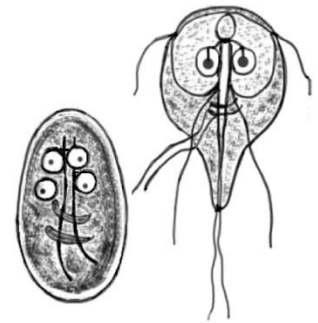
❖ **Diagnosis:**

Usually done by examining fresh feces, so you might see a trophozoite. Moreover if you left the feces, trophozoites would die, so you have to collect samples directly from the patient and keep them warm as warmth allows the trophozoites to move so you can easily detect them. However it's very difficult to observe them because trophozoites would die while the sample is being sent to the lab.

It is better to search for the cyst .In order to see the cyst, you need to add **iodine** because it is going to be stained with brown-yellowish color and with 4 nuclei and you won't be able to see trophozoites as they are killed by iodine.

✓ **Giardia Lamblia:**

- a) Pear-shaped.
- b) A member of the **flagellates**, it has **4 pairs** of flagella sticking out laterally
- c) It is concavo-convex
- d) The **dorsal** aspect of the body is **convex**.
- e) The **ventral** aspect is **flat**;the ventral site has a **sucker** to mediate its adhesion on the wall of the intestines.
- f) It has 2 nuclei and these have prominent nucleoli and with some imagination you can see an **owl** **بتبلق فيك** ,or even as a kite **الطائرة الورقية**.
- g) The cyst has 4 nuclei ,and there is a wall around it



❖ **Life cycle of Giardia Lambilia:**

Direct feco-oral route of transmission (no intermediate host) as it is living in the small intestine. It produces cysts which pass with the feces and contaminate food &water.

### ❖ Disease:

- a) Diarrhea.
- b) Malabsorption: as they attach themselves to the small intestine's wall they disturb the microvilli (brush border *الذوي الاحتياجات الخاصة*) leading to a decrease in the surface area for absorption.

The malabsorption could be caused by:

1. Mechanical causes because of the action of these discs that suck and obliterate the brush border.
2. Chemical causes are represented by toxins produced by trophozoites.

-"All In All", this damages the brush border and thus causes steatorrhea due to fat malabsorption, the stool is grayish and sticky .

-It is mainly a disease of childhood

### ❖ Diagnosis:

Mainly by examining the stools looking for **cysts** as the trophozoites will not be seen. So the patient will be diagnosed with G.Lambilia "Until proven otherwise".

Note: In order to detect the trophozoites you have to apply the **entero-test**.

### ✓ Balantidium Coli:

(BLANTIDIUM=SAC, COLI=LARGE

INTESTINE), it resembles paramecium:

- a) The only ciliated protozoa affecting human beings.
- b) Diameter ranges from 100-120 microns.
- c) Considered as one of the biggest protozoa.
- d) Reproduction is usually asexual but sometimes sexual reproduction

### READ ONLY:

An entero-test is done by swallowing a gelatin capsule attached to a long string. The end of the string remains outside the mouth and is taped to your cheek. The capsule dissolves in the stomach and the string passes into the upper part of the small intestine (duodenum).

The string is left in place for 4 to 6 hours overnight. Then it is withdrawn and the end is examined under the microscope for parasites that are attached to it.



might occur.

e) Has trophozoites which have:

1. Cilia.
2. An ant. mouth- like opening called "cytosome".
3. There are vacuoles in the cytoplasm
4. A post. anal- like opening called "cytopyge".
5. 2 nuclei:
  - i. Macronucleus: for regulating and controlling the organs functions.
  - ii. Micronucleus: for reproduction.

f) Cyst:

1. Less ciliated than the trophozite.
2. Macronucleus is more prominent than the micro nucleus.

**Note :** As we said, the parasite can reproduce sexually through the micronucleus, the micronucleus will divide first and the new two come together to exchange the DNA ,each will separate and then the new micronucleus will give rise to a new big macronucleus, so the two modes of reproduction occur in Balantidium.

❖ **Diseases:**

The main clinical manifestation is having bloody diarrhea, it is not as dysentery but might be similar to the amoebic type of dysentery.

❖ **Diagnosis:**

We have to look for the cyst in the feces and in order to decide the treatment therapy.

❖ **Their reservoir:**

It is an animal reservoir. Their reservoir is the wild hog (pig), yet they don't have an intermediate host so we can get the infection either from

contaminated human feces or hog's, and because of that it's considered as a zoonotic disease, and it's feco-orally transmitted.

✓ **Apicomplexa:**

They have anterior organelles helping them in penetrating the cell ( they are intracellular parasites )and they have both primary and intermediate hosts. In **primary hosts** they reproduce **sexually**,while in the **intermediate host** they reproduce by means of **asexual reproduction**. "**Coccidians**" are an example of the apicomplexa that has the characteristic of intermediate and primary host .

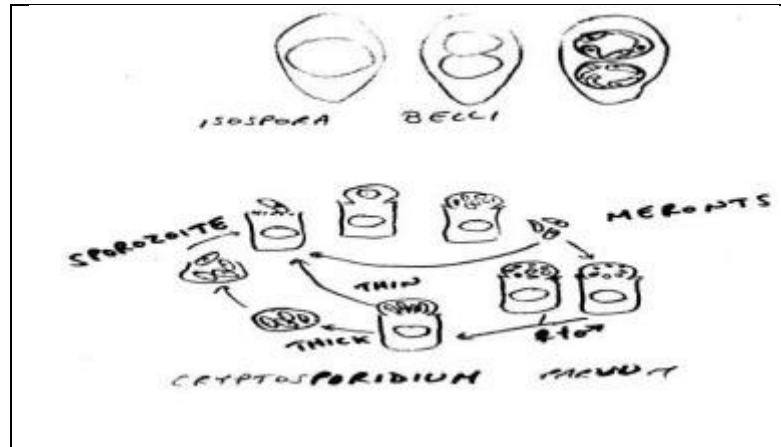
The most common 2 species are:

1. **Isospora Belli.**
2. **Cryptosporidium Parvum.**

Both are clinically irrelevant with immuno-competent patients( most are asymptomatic or they have a self limiting diarrhea ) ,while in immuno-compromised patients (esp. HIV patients) they suffer from a fatal form of diarrhea.

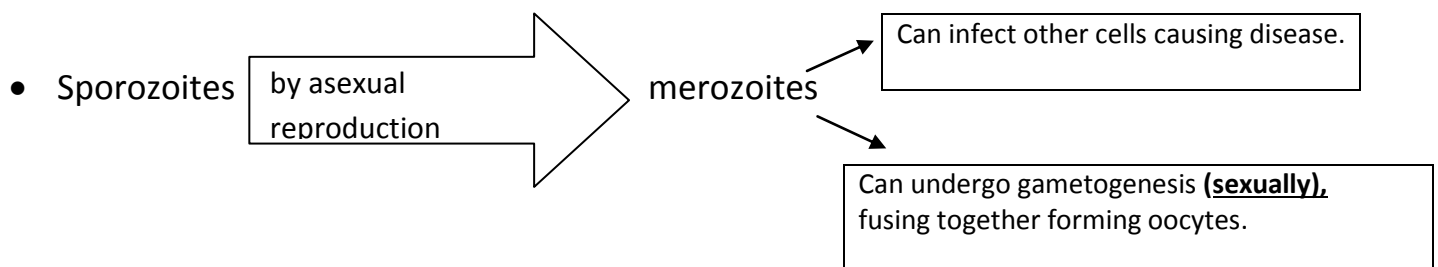
**Note** :The two previous species are an exception, there is no intermediate host , and both types of reproduction occur in the same host ( the human )

❖ Life cycle of Isospora Belli:



The infection is caused by sporozoites .

1. In the feces we have an immature oocyst which contains 1 cyst that divides into 2 Known as **SPOROCYSTS**.
2. Each sporocyst will be forming **4 SPOROZOITES**.
3. Now eating food contaminated with mature oocysts that contain sporozoites , the sporozoites will invade the cells of small intestine and damage them , they will reproduce there .
4. The replicated sporozoites will give rise to **MEROZOITES** that invade other cells and cause the diarrhea
5. The morozoites will become an **OOCYST** by gametogenesis (sexual reproduction) which exits through the feces, and the cycle goes on and on.



### **Cryptosporidium Parvum:**

Same story, The oocyst contains sporozoites which go to the intestines and invade the enterocytes, and the unique thing about them is that they stay at the apex of the cell so they infect the apical side of the enterocyte, they are not in the middle. They will give rise to merozoites which divide and multiply asexually. These merozoites can also transform themselves into gametocytes which could be:

1. Small ones called micro-gametocytes.(sperm)
2. Large ones called macro-gametocytes.(ovum)

They fuse together forming a zygote that develops into oocyst that contains the sporozoites which are the infectious agent.

The oocyst can be divided into 2 groups according to the thickness of their walls:

1. Thin wall covering known as the thin oocyst, this variety doesn't leave the body and it ruptures releasing sporozoites producing infection in the same person.
2. Thick wall covering known as the thick oocyst containing sporozoites that come out with feces causing infection to other people.

*Ladies and Gentlemen, that was that for today's lecture;*

*Rami Afifi&YousefAbdeh are at your service \o/.*

*"It's impossible" said pride.*

"It's risky" said experience.

"It's pointless" said reason.

"قوم هز طولك وسويلك شغلة مفيدة تنفعك وتنفع غيرك". said Rami & I.

This sheet is dedicated to our buddies:

Abdallah Awad.

Abdulrahman Diab.

Ahmad Tarawneh.

Ahm Almasri.

Ali Lattouf & Shrouf.

Amal Orabi.

Basim Alsababha.

Hassan Hammo.

Jamil المسيطر.

Lana Abusubaih.

Louai Smeirat.

Majd Haddad.

Omar Dwekat.

Rajai' Zurikat.

Riko Radi.

Sewar Bishara.

Sondus Halasi.

And:

للنفسيات بتعرفوا ليش؟! جكر فيهم عشانهم نفسيات :P

A special  
dedication for the  
correction team :D