



Intestinal, Oral, and Genital Flagellates

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Parasitic protozoa, which possess **whip-like flagella** as their organs of locomotion are called as **flagellates** and classified as—

Phylum: Sarcomastigophora

Subphylum: Mastigophora

Class: Zoomastigophora (*mastix: whip*)

- Depending on their habitat, they can be considered under:
 - **Lumen-dwelling flagellates:** Flagellates found in the alimentary tract and urogenital tract (Table 4.1).
 - **Hemoflagellates:** Flagellates found in blood and tissues (Table 4.1).
- Most luminal flagellates are nonpathogenic commensals. Two of them cause clinical diseases—*Giardia lamblia*, which can cause diarrhea and *Trichomonas vaginalis*, which can produce vaginitis and urethritis.

Giardia Lamblia

History and Distribution

It is one of the earliest protozoan parasite to have been recorded.

- The flagellate was first observed by Dutch scientist Antonie von Leeuwenhoek (1681) in his own stools.
- It is named '*Giardia*' after Professor Giard of Paris and '*lamblia*' after Professor Lambie of Prague, who gave a detailed description of the parasite.
- It is the most common protozoan pathogen and is worldwide in distribution.
- Endemicity is very high in areas with low sanitation, especially tropics and subtropics. Visitors to such places frequently develop traveller's diarrhea caused by giardiasis through contaminated water.

Table 4.1: Flagellates

Group	Parasites	Habitat
Lumen-dwelling flagellates	<i>Giardia lamblia</i> <i>Trichomonas vaginalis</i> <i>Trichomonas tenax</i> <i>Trichomonas hominis</i> <i>Chilomastix mesnili</i> <i>Enteromonas hominis</i> <i>Retortamonas intestinalis</i> <i>Dientamoeba fragilis</i>	Duodenum and jejunum Vagina and urethra Mouth Large intestine (caecum) Large intestine (caecum) Large intestine (colon) Large intestine (colon) Large intestine (colon) Large intestine (caecum and colon)
Hemoflagellates	<i>Leishmania</i> spp. <i>Trypanosoma brucei</i> <i>Trypanosoma cruzi</i>	Reticuloendothelial cells Connective tissue and blood Reticuloendothelial cells and blood

Habitat

G. lamblia lives in the duodenum and upper jejunum and is the only protozoan parasite found in the lumen of the human small intestine.



Protozoans found in small intestine

- *Giardia lamblia*
- *Isospora belli*
- *Cyclospora caytenensis*
- *Cryptosporidium parvum*
- *Sarcocystis hominis* and *suihominis*

Morphology

It exists in 2 forms:

- Trophozoite (or vegetative form)
- Cyst (or cystic form).

Trophozoite

The trophozoite is in the shape of a tennis racket (**heart-shaped** or **pyriform shaped**) and is rounded anteriorly and pointed posteriorly (Figs. 4.1 and 4.2A and B).

- It measures 15 μm x 9 μm wide and 4 μm thick.
- Dorsally, it is convex and ventrally, it has a concave sucking disc, which helps in its attachment to the intestinal mucosa.
- It is bilaterally symmetrical and possesses.
 - 1 pair of nuclei
 - 4 pairs of flagella
 - Blepharoplast, from which the flagella arise (4 pairs)
 - 1 pair of axostyles, running along the midline

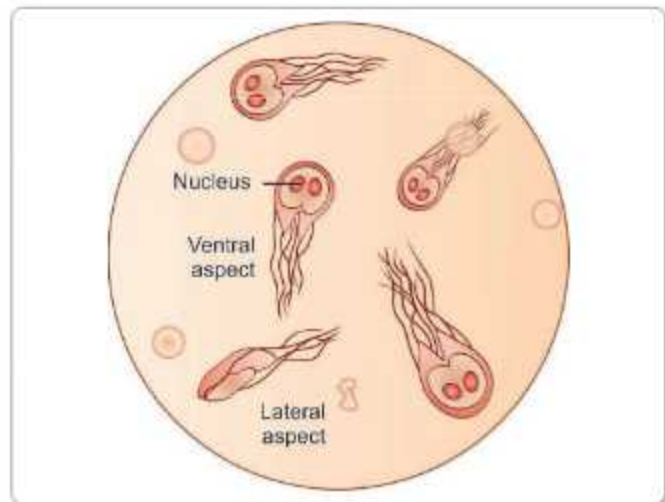


Fig. 4.1: *Giardia lamblia* in duodenal fluid wet preparation.
Magnification X 1500

- Two sausage-shaped parabasal or median bodies, lying transversely posterior to the sucking disc.
- The trophozoite is motile, with a slow oscillation about its long axis, often resembling **falling leaf**.

Cyst

It is the infective form of the parasite (Fig. 4.2C).

- The cyst is small and oval, measuring 12 μm x 8 μm and is surrounded by a hyaline cyst wall.
- Its internal structure includes 2 pairs of nuclei grouped at one end. A young cyst contains 1 pair of nuclei.
- The axostyle lies diagonally, forming a dividing line within cyst wall.
- Remnants of the flagella and the sucking disc may be seen in the young cyst.

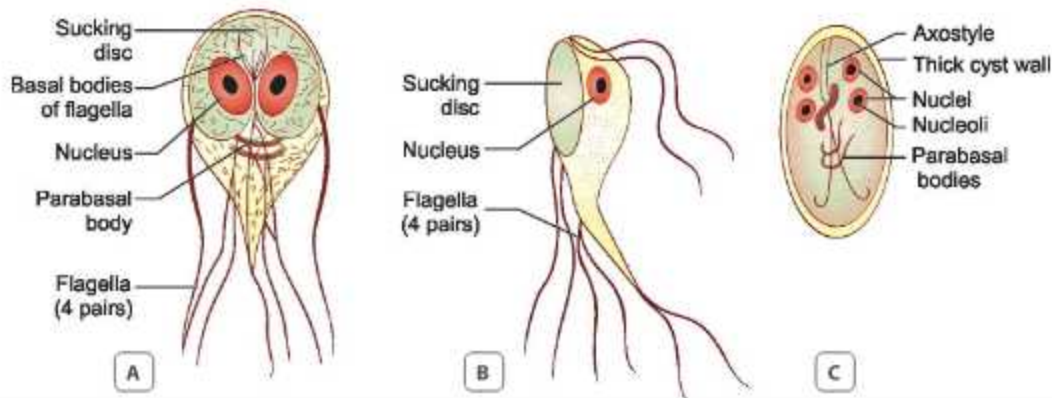


Fig. 4.2: Trophozoite. A. Ventral view; B. Lateral view; C. Quadrinucleate Cyst

Life Cycle

Giardia passes its life cycle in **1 host**.

Infective form: Mature cyst.

Mode of transmission:

- Man acquires infection by ingestion of cysts in contaminated water and food.
- Direct person-to-person transmission may also occur in children, male homosexuals, and mentally-ill persons.
- Enhanced susceptibility to giardiasis is associated with blood group A, achlorhydria, use of cannabis, chronic pancreatitis, malnutrition, and immune defects such as 19A deficiency and hypogammaglobulinemia.
- Within half an hour of ingestion, the cyst hatches out into two trophozoites, which multiply successively by binary fission and colonize in the duodenum (Fig. 4.3).
- The trophozoites live in the duodenum and upper part of jejunum, feeding by pinocytosis.
- During unfavorable conditions, encystation occurs usually in colon (Fig. 4.3).
- Cysts are passed in stool and remain viable in soil and water for several weeks.
- There may be 200,000 cysts passed per gram of feces.
- **Infective dose** is 10–100 cysts.

Pathogenicity and Clinical Features

G. lamblia is typically seen within the crypts of duodenal and jejunal mucosa. **It does not invade the tissue**, but remains tightly adhered to intestinal epithelium by means of the sucking disc.

- They may cause abnormalities of villous architecture by cell apoptosis and increased lymphatic infiltration of lamina propria.
- Variant specific surface proteins (VSSP) of giardia play an important role in virulence and infectivity of the parasite.
- Often they are asymptomatic, but in some cases, *Giardia* may lead to mucus diarrhea, **fat malabsorption** (steatorrhea), dull epigastric pain, and flatulence. The stool contains excess mucus and fat but no blood.
- Children may develop chronic diarrhea, malabsorption of fat, vitamin A, protein, sugars like xylose disaccharides, weight loss, and sprue-like syndrome.
- Occasionally, *Giardia* may colonize the gall bladder, causing biliary colic and jaundice.
- Incubation period is variable, but is usually about **2 weeks**.

Protozoan parasites causing diarrhea

- | | |
|----------------------------------|---------------------------------|
| • <i>Giardia lamblia</i> | • <i>Entamoeba histolytica</i> |
| • <i>Cyclospora cayetanensis</i> | • <i>Cryptosporidium parvum</i> |
| • <i>Isospora belli</i> | |

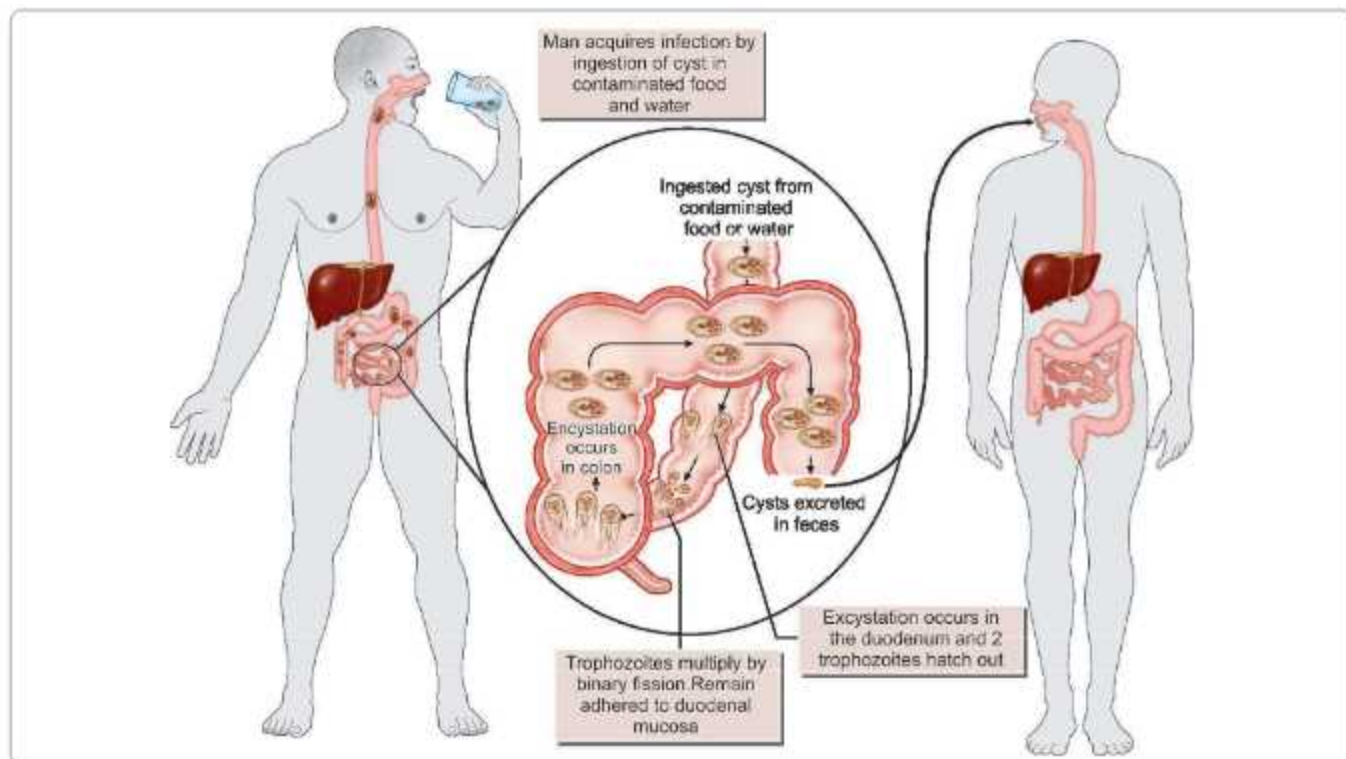
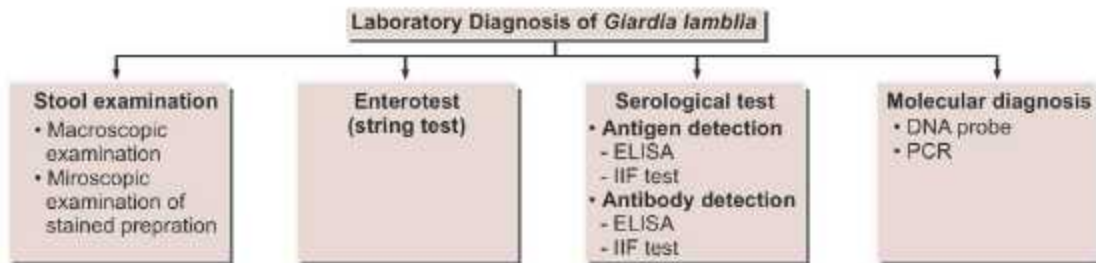


Fig. 4.3: Life cycle of *Giardia lamblia*

Flowchart 4.1: Laboratory diagnosis of *Giardia lamblia*

Laboratory Diagnosis

Stool Examination

Giardiasis can be diagnosed by identification of cysts of *Giardia lamblia* in the formed stools and the trophozoites and cysts of the parasite in diarrheal stools (Flowchart 4.1).

- On macroscopic examination fecal specimens containing *G. lamblia* may have an offensive odor, are pale colored and fatty, and float in water.
- On microscopic examination, cysts and trophozoites can be found in diarrheal stools by saline and iodine wet preparations.
- Often multiple specimens need to be examined and concentration techniques like formal ether or zinc acetate are used. In asymptomatic carriers, only the cysts are seen.

Enterotest (String test)

A useful method for obtaining duodenal specimen is **enterotest**. A coiled thread inside a small weighted gelatin capsule is swallowed by the patient, after attaching the free end of the thread in the cheek. The capsule passes through the stomach to the duodenum. After 2 hours, the thread is withdrawn, placed in saline, and is mechanically shaken. The centrifuged deposit of the saline is examined for *Giardia*. The use of enterotest is not recommended because of the very high cost of the test.

Serodiagnosis

Antigen detection

Enzyme-linked immunosorbent assay (ELISA), immunochromatographic strip tests and indirect immunofluorescent (IIF) tests using monoclonal antibodies have been developed for detection of *Giardia* antigens in feces (Flowchart 4.1).

- The presence of antigen indicates active infection.
- Commercially available ELISA kits (ProSpec T/*Giardia* kit) detects *Giardia*-specific antigen 65 (GAS 65).

- The sensitivity of the test is 95% and specificity is 100%, when compared to conventional microscopy.
- The test may be used for quantification of cysts and in epidemiological and control studies, but not for routine use.

Antibody detection

IIF test and ELISA are used to detect antibodies against *Giardia*.

- Demonstration of antibodies is useful in the epidemiological and pathophysiological studies.
- These tests cannot differentiate between recent and past infection and lack sensitivity and specificity.

Molecular Method

DNA probes and polymerase chain reaction (PCR) have been used to demonstrate parasitic genome in the stool specimen (Flowchart 4.1).

Treatment

Metronidazole (250 mg, thrice daily for 5–7 days) and tinidazole (2 g single dose) are the drugs of choice.

- Cure rates with metronidazole are more than 90%.
- Tinidazole is more effective than metronidazole.
- Furazolidone and nitazoxamide are preferred in children, as they have fewer adverse effects.
- Paromomycin, an oral aminoglycoside can be given to symptomatic pregnant females.

Note: Only symptomatic cases need treatment.

Prophylaxis

Giardiasis can be prevented by following measures:

- Proper disposal of waste water and feces.
- Practice of personal hygiene like hand-washing before eating and proper disposal of diapers.
- Prevention of food and water contamination. Community chlorination of water is ineffective for inactivating cysts. Boiling of water and filtration by membrane filters are required.