



Protozoa (Subclass –Coccidia)

Phylum: Apicomplexa

Class: Sporozoa

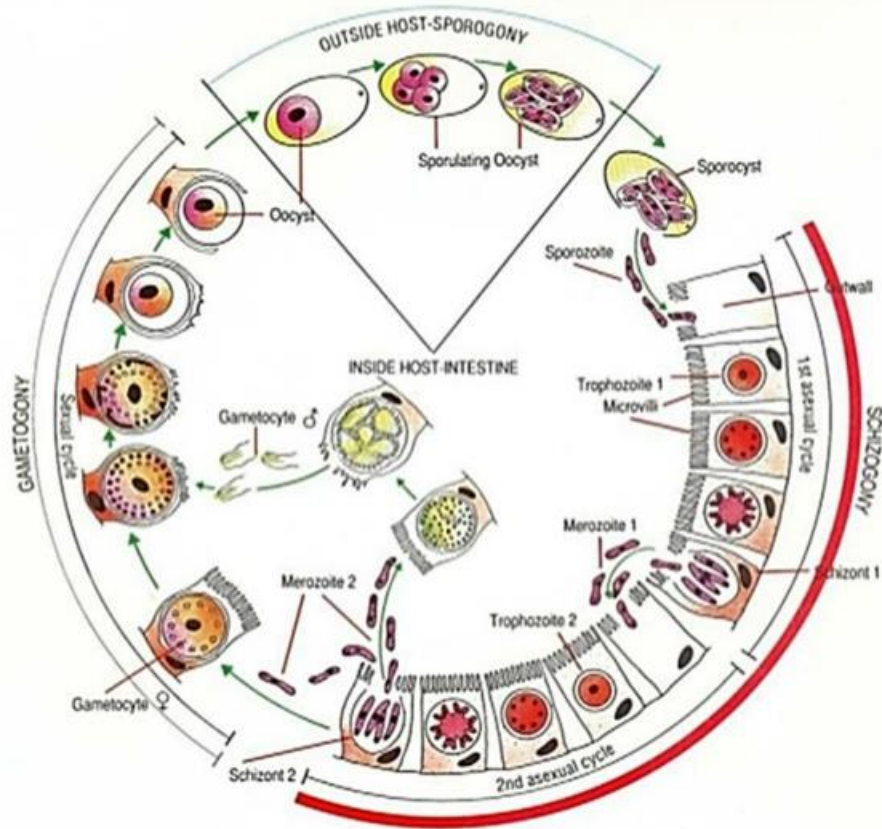
Subclass: Coccidia

Genus : *Toxoplasma, Cryptosporidium, Isospora, Sarcocystis*

Coccidian life cycle:

Three parts:

- Schizogony (asexual reproduction) (in the host)
Sporozoites → schizont → merozoites.
- Gametogony (sexual reproduction) (in the host)
Merozoites → male & female gamete → fertilize → oocyst
- Sporogony (asexual reproduction)
Oocyst → sporulated oocyst → sporocyst → sporozoites

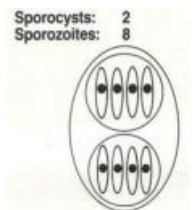


- Notes:

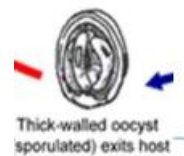
- The infective stage for (4 genera) is the sporulated oocyst

- Infective (sporulated) oocyst of:

- ~~Toxoplasma~~, ~~Isoospora~~, ~~Sarcocystis~~ contains two sporocyst each one contain four sporozoites.



- ~~Cryptosporidium~~ contains only four sporozoites.





Toxoplasma gondii (Toxoplasmosis)

Toxoplasmosis

- Is a zoonotic disease caused by coccidian protozoan *Toxoplasma gondii*.
- Infects a wide range of animals, birds but does not appear to cause disease in them.

Toxoplasma gondii

- Has very low host specificity, and it will probably infect almost any mammal.
- It invades all kinds of cells (obligate intracellular parasite).
- Cats (both domestic and wild) are the only definitive hosts and can also be the intermediate hosts.
- Toxoplasmosis is a significant cause of morbidity and mortality in AIDS patients and congenitally infected infants (opportunistic infection for human).

Geographical distribution: Wide world distribution.

Habitat: Macrophage of reticulo-endothelial system.

Life Cycle

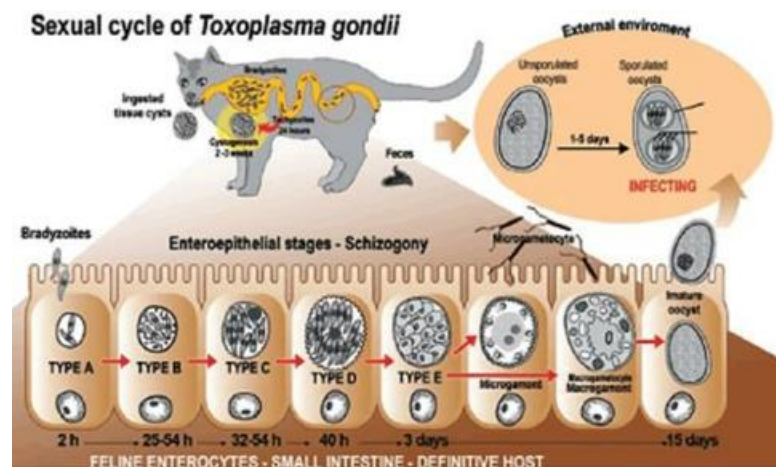
- The life cycle includes two phases called the intestinal and extra-intestinal phases.
- The intestinal phase occurs in cats only and produces “oocysts”.



- The extra-intestinal phase occurs in all infected animals and produces “tachyzoites” and eventually “bradyzoites”.

A. Sexual cycle in Cat (Intestinal phase)

- Only members of the cat family shed oocysts.
- Cats become infected by ingesting:
 - i. Oocysts from fecal contamination.
 - ii. Tissue cysts present in flesh of eaten animals.
- The organisms reproduce, producing high number of non-infectious, unsporulated oocysts that are excreted in the feces of cats for up to 2 weeks.
- Once outside of the cat body, sporogony occurs for up to (2–5 days), resulting in the development of infectious oocysts.



B. Asexual cycle in Man & Animals (Extra-intestinal cycle):

The Infective stage for man:

sporozoites, comes from three forms.

1. Sporozoites within mature oocyst:

- This is found in feces of cat and other feline.
- each with 4 crescentic sporozoites.

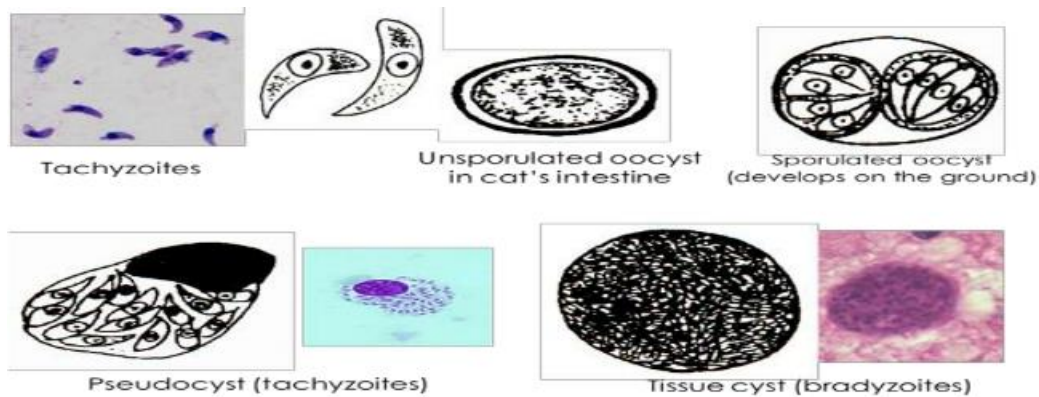


2. Tachyzoites within pseudocyst.

It is found in the acute stage of the parasite in any reticuloendothelial system or parenchymal tissue of man or other mammals,

3. Bradyzoites:

Within true cyst contain ,it is present in chronic stage of the parasite.



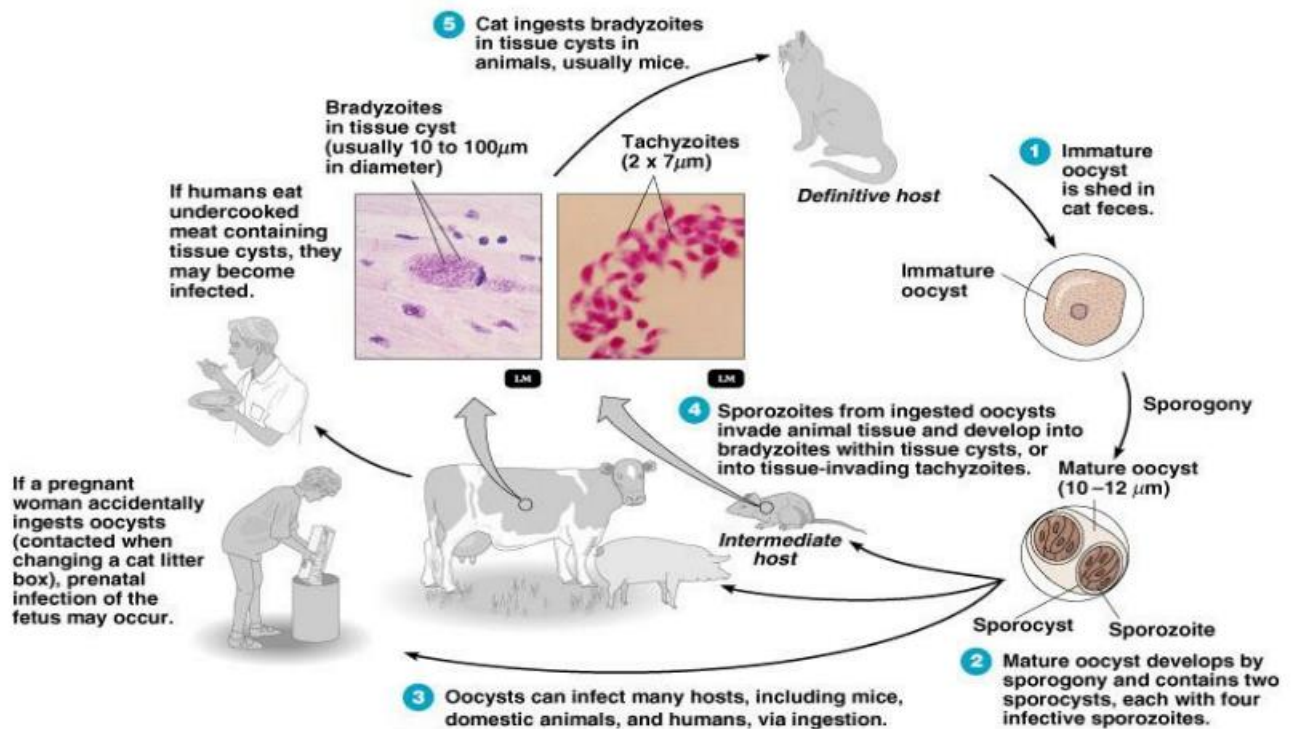
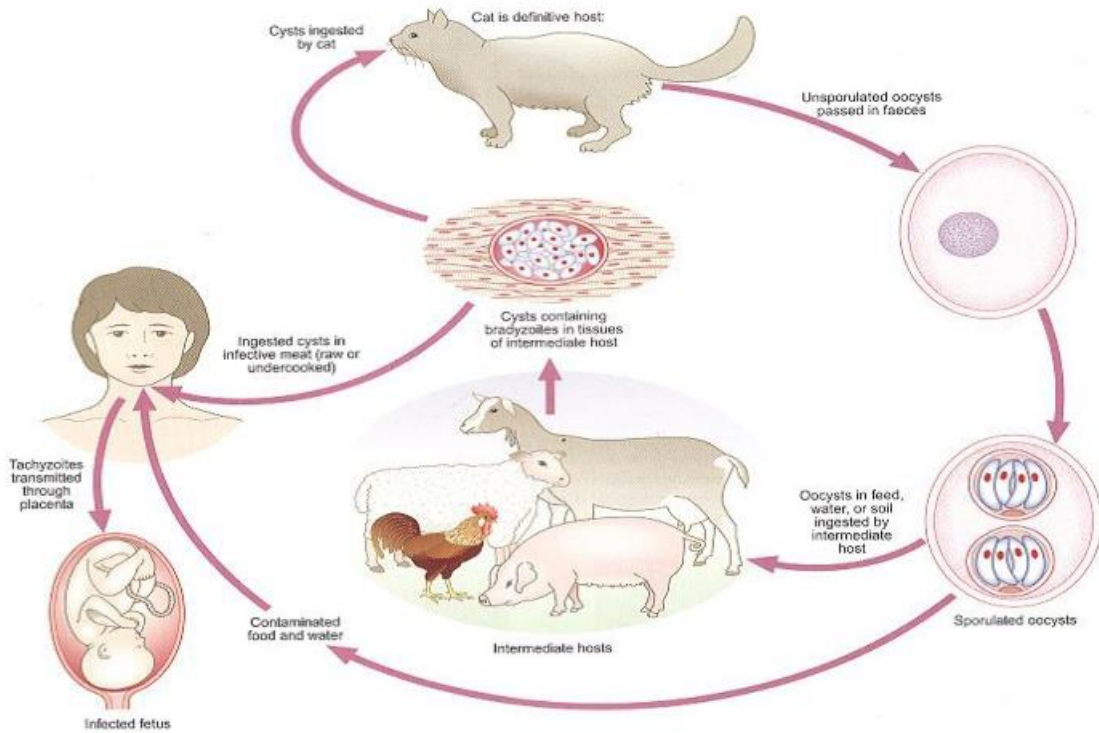
Mode of transmission of T.gondii:

Major Routes of Transmission:

1. Ingestion of under-cooked meat contaminated with T.gondii(cyst stage, pseudocyst or true cyst).
2. Ingestion of contaminated food or water (oocyst).
3. Transplacental transmission from mother to fetus, when T.gondii is contracted during pregnancy.

Minor Routes of Transmission.:

1. Blood transfusion from donors to recipient
2. Organ transplantation.
3. Drinking of non-pasteurized milk from infected cow.



Copyright © 2004 Pearson Education, Inc., publishing as Benjamin Cummings.

Life cycle of *Toxoplasma gondii*



Note:

- **pseudocysts** in the acute stage of the disease.

Common sites are: lymphoid tissue – lung – heart – CNS.

- In Immunocompetent hosts, multiplication slow down giving rise to bradyzoites – encystation in the (**chronic stage**).

Pathogenesis:

1. Congenital Toxoplasmosis

- Focal lesion develop in the placenta.
- The infection is firstly generalized, later the parasite is cleared from the viscera and localizes mainly in the CNS & eye.
- Ocular Lesion start by proliferation of parasite and retina inflammation lead to “Retinochoroditis”

Severity is dependent on :

- **Protective immunity of the mother.**
- **Age of the fetus at the time of infection.**

Infection during pregnancy lead to:

- Loss of the fetus (abortion or still birth).



- Full Term baby with complication .



2-Acquired Toxoplasmosis

- **Tachyzoites** are found within cells of lymphoid tissue, lung, heart, CNS & eye.
- Actively multiplying focal area of necrosis surrounded by cellular inflammatory infiltrate “**acute Stage**”.
- Competence of host’s immunity coincides with development of latent infection & formation of tissue cyst containing **bradyzoites** “**chronic stage**”
- Tissue cysts are more prevalent in the brain, eye, skeletal & cardiac muscles.

Depends on :

- **Immune status and age of infected person.**
- **Virulence of infecting strain of Toxoplasma.**

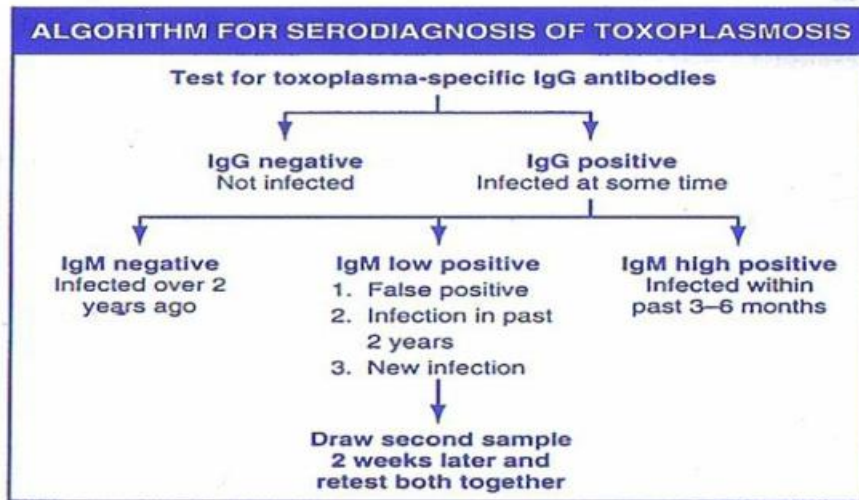
Recrudescence (Reactivation) Toxoplasmosis

- Suppressed immunity may results in reactivation of tissue cysts.
- Immune suppression may be due to AIDS, organ transplant, neoplastic disease results in deficient cell mediated immunity, with development of severe progressive disease.



Diagnosis :

1. Serological tests – IHA, IFA, ELISA (IgM/IgG)



2. Microscopic Examination

- Diagnosis can be made by direct observation of the parasite in stained slide from biopsy of bone marrow, lymphoid or spleen.

3. Animal Inoculation

- Mice inoculation by tissue emulsion of brain, lung or body fluid or clean sporulated oocyst I/P.
- Oocyst detect in brain at 4–6w post infection and tachyzoite in peritoneal fluid at 4–6w post infection.

Control :



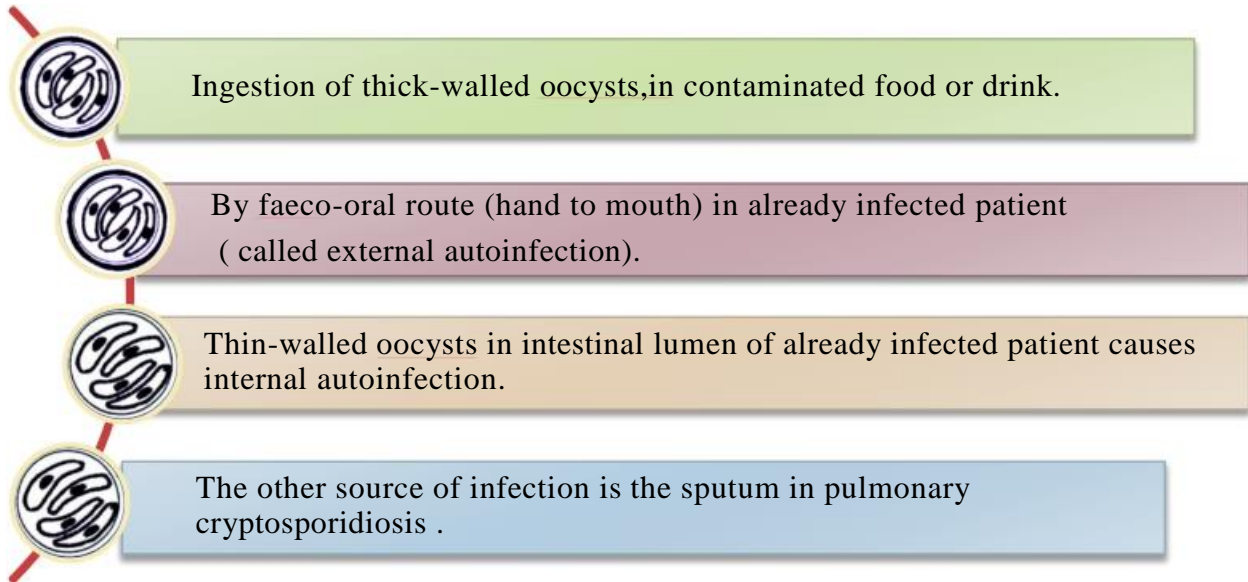
- Avoid undercooked meat, fruits and vegetables should be washed prior to consumption.
- Prevent exposure of pregnant women to infection. Screening of pregnant women for Toxoplasma antibodies.
- Avoid contact with materials contaminated with cat feces, handling cat litter boxes. Wear gloves during gardening.

Cryptosporidium parvum (cryptosporidiosis)

- Cryptosporidium is a coccidian protozoan parasite.
- This parasite is one of the **opportunistic parasites** (present in the human body without any harmful effect, but as soon as the immune response of the host is suppressed due to other causes the parasite is activated which leads to severe illness).
- Cryptosporidiosis is **zoonotic disease** (some species can be transmitted from animals to human).
- Cryptosporidium is **acid fast protozoan** parasite

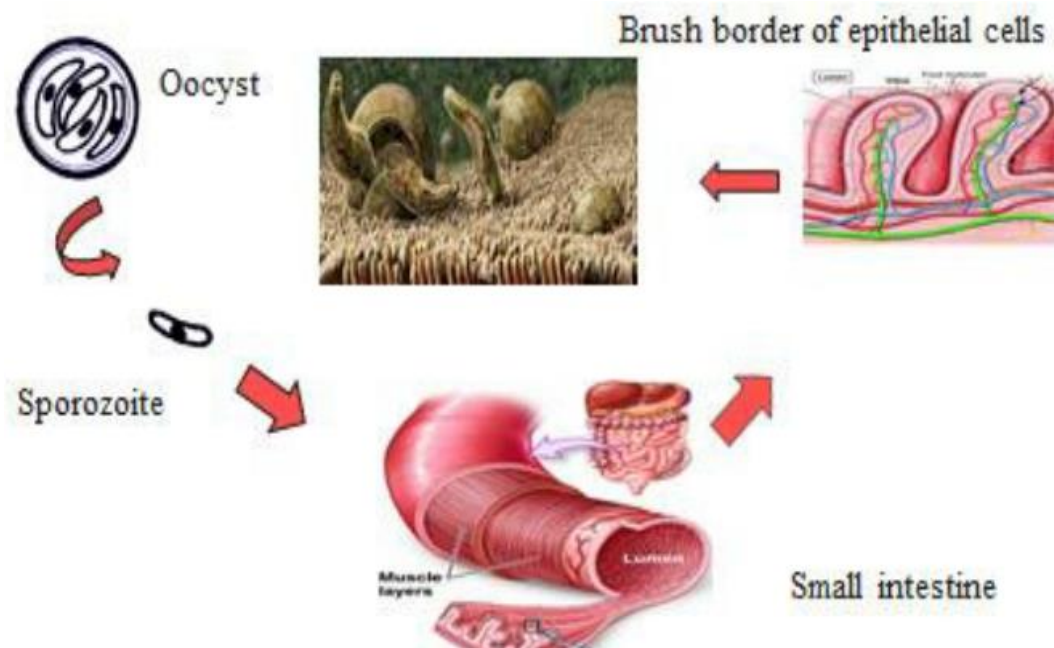


Mode of Transmission:



Habitat :

Brush border of epithelial cells





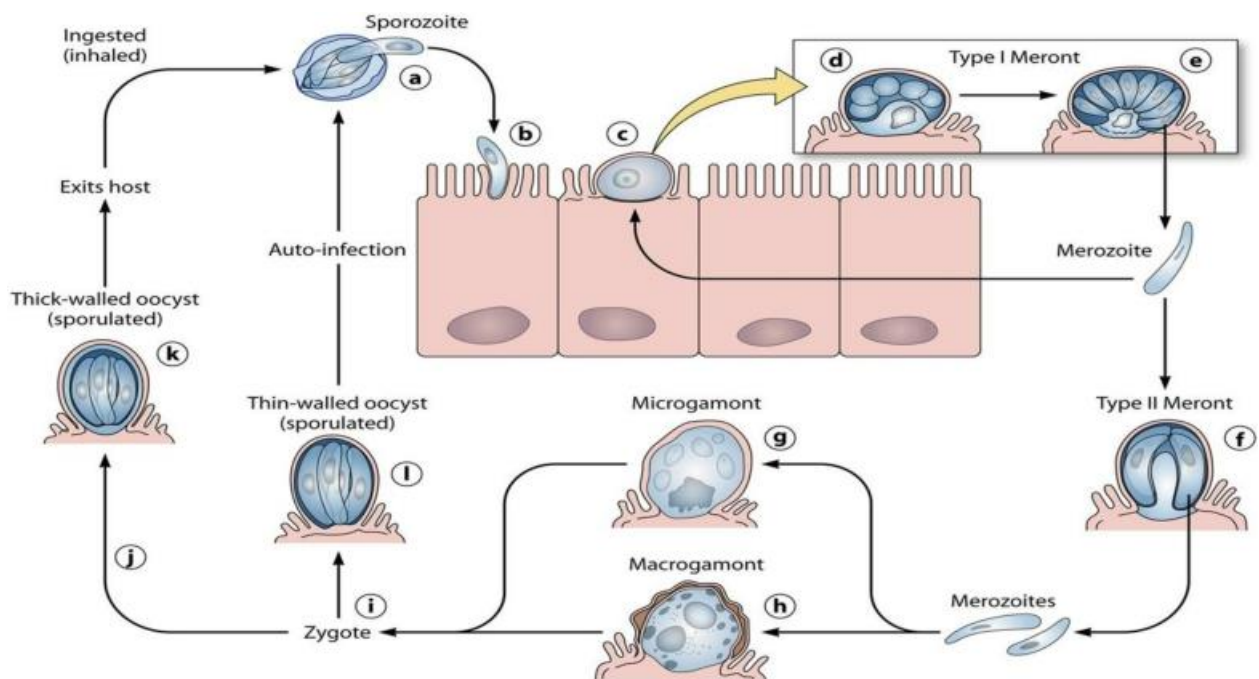
Life cycle:

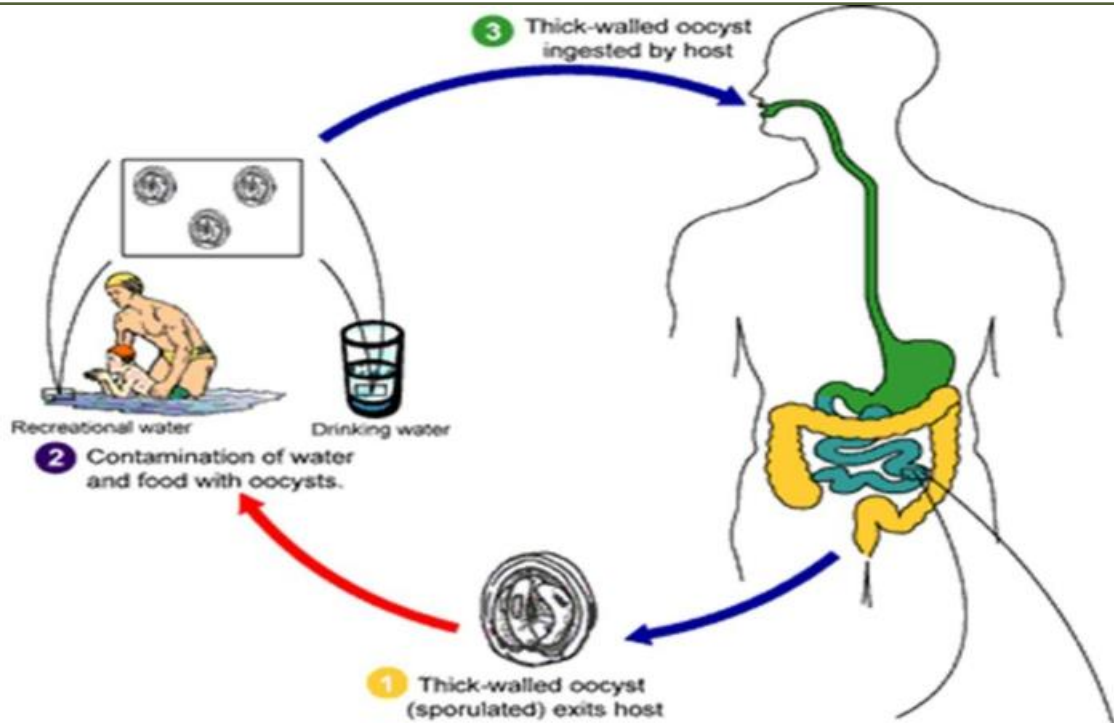
- Complex **monoxenous** life cycle--completing its entire cycle within a single host with both sexual and asexual cycles.

Hosts:

Definitive hosts: Host non -specific but able to infect mammal e.g. human.

Intermediate host : None





Life cycle of *C.parvum*

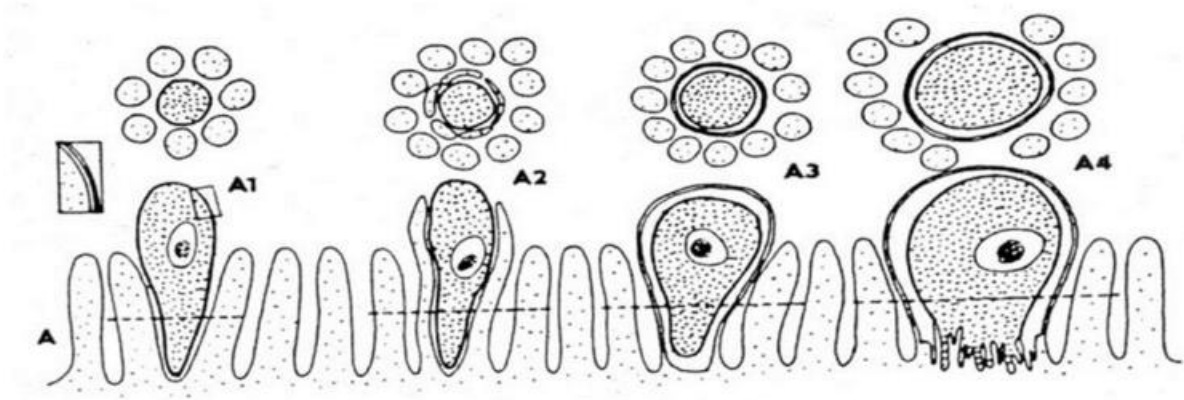
Risk groups

1. **Children** who attend day care centers, child care workers, family of infected children.
2. **Travelers** to endemic areas.
3. **Swimmers** who swallow contaminated swim water.
4. **Animal handlers**
5. **People with weakened immune systems** may develop serious, chronic, and sometimes fatal illness: AIDS, cancer and transplant patients

Pathogenesis:



- The incubation period is estimated to be 1–12 days, with an average of 7 days.
- The parasite is located in the brush border of the epithelial cells of the small intestine.
- When the sporozoites attach the epithelial cells' membrane envelops them. Thus, they are “intracellular but extracytoplasmic”



- The parasite can cause damage to the microvilli where it attaches.
- The infected human excretes the most oocysts during the first week.
- Oocysts can be excreted for weeks after the diarrhea subsides.

Clinical Manifestations

In Immunocompetent Patients

- Cryptosporidiosis is an acute, self-limiting diarrheal illness.
- symptoms include:

Frequent, watery diarrhea, abdominal pain.

In Immunocompromised Persons

- Illness is much more severe:
Cholera-like diarrhea, severe abdominal pain, fever, weight loss
Nausea & vomiting.

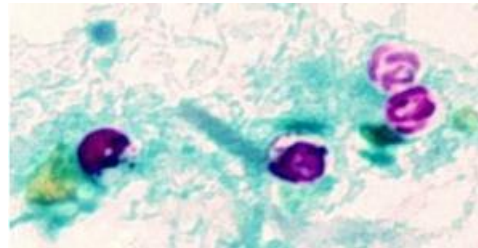
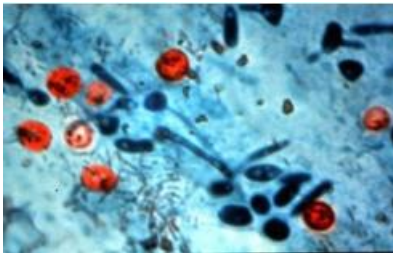


Complication:

- Malnutrition resulting from poor absorption of nutrients from intestinal tract (malabsorption)
- Severe dehydration
- Significant weight loss (wasting)
- Pulmonary disseminated.

Diagnosis:

1. Direct microscopic examination of stool.
 2. Stool concentration smear, best result are obtained with it.
 3. Stained smear by using modified acid fast–stain.
- Cryptosporidium stains red, the back ground materials stained blue.
4. Indirect Immunofluorescence test: oocyst have been detected in fecal specimens.
 5. ELISA test for detection of fecal antigen.
 6. PCR is used to detect. *C. parvum* stool specimens.



Oocysts of *Cryptosporidium parvum* stained by the modified acid-fast method. A blue-green background, the oocysts stand a bright red stain.

Sporozoites are visible inside the oocysts .

Control :

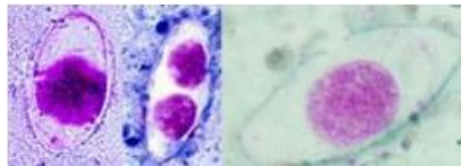


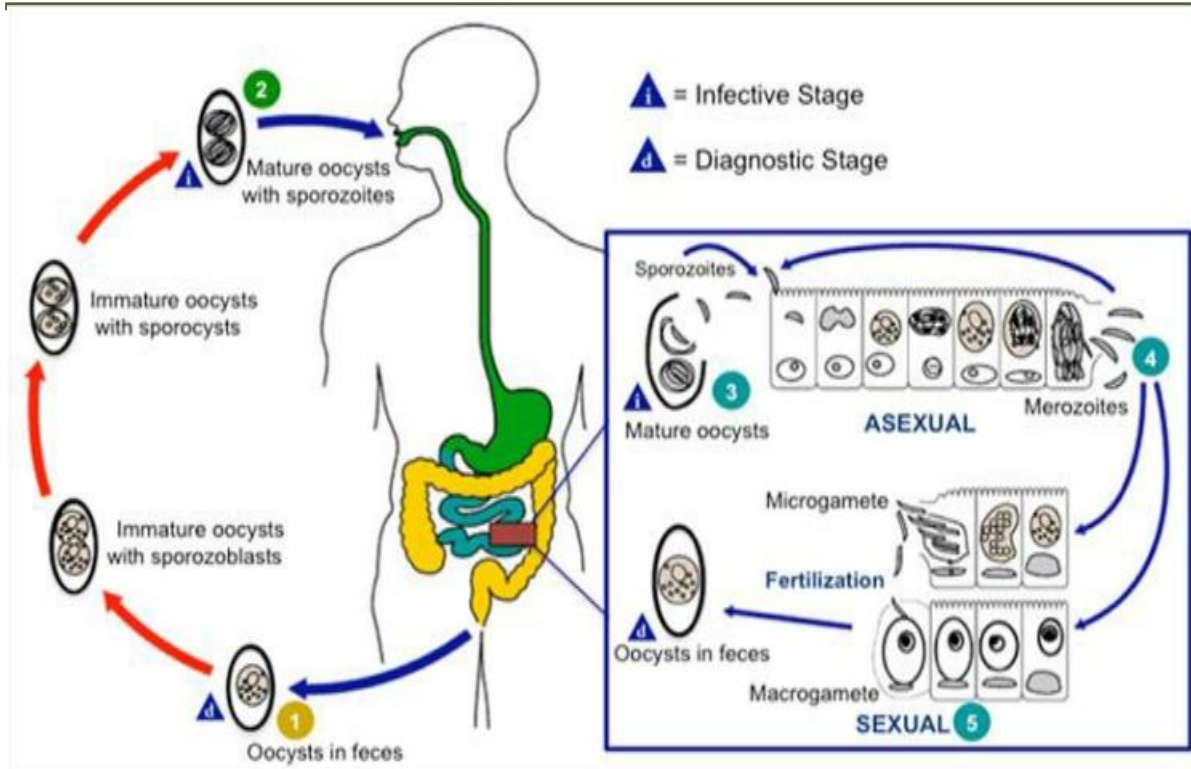
- Water purification and filtration., use of 1 micron filter to remove oocysts.
- Boil water.
- Drink bottled water when traveling to endemic area.
- Educate public
- Wash hands frequently.

Isosporabelli(coccidiosis)

- It is the causative agent of human coccidiosis.
- ~~The mode of infection~~ orally with contaminated food and water.
- Wide ~~geographical distribution~~ (higher prevalence in warm climates).
- ~~Acid-fast~~ protozoa, probably ~~not zoonosis~~
- ~~Opportunistic parasite.~~

Morphology: The oocyst contains two sporocysts, each with 4 sporozoites





Life cycle of *I. belli*

Pathogenesis:

- Invades intestinal epithelial cells.
- Symptoms range from mild gastro-intestinal distress to severe dysentery.
- Often self-limiting, but can become chronic (wasting, anorexia).
- Symptoms more severe in AIDS patients.

Pathological changes:

- Abnormal intestinal mucosa,
- Short villi,
- Hypertrophied crypts
- Inflammatory cells infiltration of lamina propria.

Diagnosis:

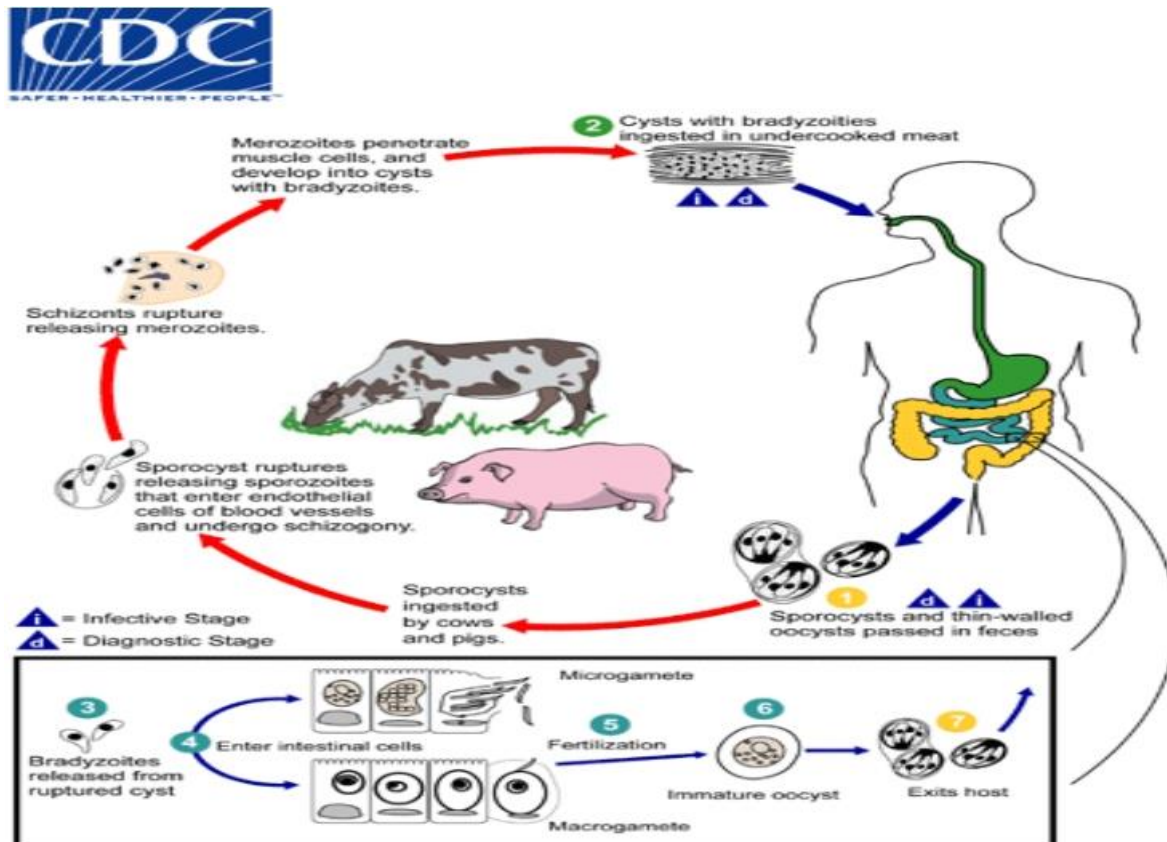


1. Stool examination.
2. Concentration (flotation or sedimentation).
3. Modified acid-fast stain.

Sarcocystislindemanni

- Infection for cattle and pigs accidentally human.
- Sarcocystisinfection is usually asymptomatic.

Life cycle:



Life cycle of *S.lindemanni*



- Mature oocyst are usually passed with feces. However, in many cases the oocyst ruptured and only the sporocysts are visible.
- The sporocysts may be seen singly or pairs that appear to be cemented together.
- **Cyst present in the skeletal & cardiac muscle.**
- Encapsulated
- Elongated body with pointed ends.
- Lies parallel to the muscle fiber.
- Contains crescentic zoites (Rainey's corpuscles)

