Coccidia

Aims: Human coccidiosis is produced by species of *Isospora*; is more important in immunocompromised patients like (AIDS, and kidney transplant patients), and in malnourished children.

Objectives:
1. Scientific classification
2. What are coccidia?
3. What is Coccidiosis?
4. General characteristic of the Coccidia:
5. *Isospora belli*

1. Scientific classification
   Phylum: Apicomplexa
   Class: Sporozoa
   Subclass: Coccidia

2. What are coccidia?
   Coccidia are small protozoans (one-celled organisms), which are members of the class Sporozoa, an exclusively parasitic group that typically requires alternation of sexual and asexual reproduction in the life cycle.
   Some workers believe it is a yeast; however, until its taxonomic position and life cycle are more completely known, it can be regarded as a protozoan.

3. What is Coccidiosis?
   Coccidiosis is the disease caused by coccidian infection. Coccidiosis is a parasitic disease of the intestinal tract of humans and other animals, caused by coccidian protozoa.
   Coccidian organisms can infect a wide variety of animals, including humans, birds, and livestock, they are usually species-specific. One well-known exception is toxoplasmosis, caused by *Toxoplasma gondii."
   People often first encounter coccidia when they acquire a young puppy or kitten who is infected. The infectious organisms are canine/feline-specific and are not contagious to humans (compare to zoonotic diseases).

The species of medical importance is found in subclass Coccidia and cause disease of human include one of the following genera:
1. Genus *Isospora*.
2. Genus *Cryptosporidium*.
3. Genus *Toxoplasma*.
4. Genus *Plasmodium*.
5. Genus *Sarcocystis*.

The term *Coccidia* is also applied for immature oocyst of *Isospora* and *Eimeria* genera. After the maturation of these oocyst which is found in fecal specimen of
vertebrates (mammals, birds). In lab. by using 2.5% potassium dichromate solution, these mature oocyst is either:

a. If contain 2 sporocyst each one with four sporozoites (these oocyst belong to Genus *Isospora*).

b. If contain 4 sporocyst each one with 2 sporozoites (these oocyst belong to Genus *Eimeria*).

4. General characteristic of the Coccidia:
   1. Locomotive organelles absent, the flagella present only in male gamete.
   2. Life cycles are complex, with well-developed sexual (which produce merozoites, some of these merozoites differentiate into macro and microgametes) and sexual stages (which produce oocysts).
   3. Sporozoa produce special spore like cells called sporozoites.
   4. It is intracellular parasite with complex cycle alternating between humans and mosquitoes as in malaria, while in *T. gondii* which causes an acute infection in human is acquired from cats and other animals.
   5. Have similar independent gametocytes, the male or microgametocyte and female or macrogametocyte. The female produce a single macrogamete and the male produce multiple gametes, following an oocyst is formed after fertilization.
   6. The oocyst in species of *Isospora* and *Sarcocyst* is produces two internal sporocysts, each with four sporozoites, in *Cryptosporidium* the sporocyst stage is omitted.
   7. Only two species of coccidian are known to undergo shizogony and gametogony in man *Isospora belli* and *Cryptosporidium muris*.

*Isospora belli*:

It is the only species of *Isospora* that infect man, although large no. of *Isospora* species infect mammals, birds & other vertebrates hosts.

*Isospora belli* is a coccidian protozoan that infects humans and some primates. This species was first recorded in 1915 by Dr. H.M. Woodcock when he observed coccidian oocysts in the feces of World War I soldiers overseas. Since then *I. belli* has been studied as the causal agent in the intestinal disease *Isosporiasis*. This protozoan is frequently responsible for the phenomenon known as “traveler’s
Diarrhea. “I. belli” is found throughout the world but is more common in tropical and subtropical locations. It is the least common of the three coccidian parasites that infect human intestines (Cryptosporidium, Toxoplasma, & Isospora).

**Disease:** The disease caused by *I. belli* is called intestinal Coccidiasis or Coccidiasis belli or Isosporiasis. This disease is typically mild in healthy individuals but can be life threatening in people who are young or immunodepressed. *Isosporiasis* was largely ignored until its recent emergence as one of the opportunistic infections affecting AIDS patients.

**Mode of transmission:**
*Isosporiasis* is usually transmitted through ingestion of sporulated oocysts from contaminated food and water. However, because isosporiasis is frequently seen in homosexuals than in the general population, it is suggested that sexual transmission, especially through oral-anal sexual practice, may have an important role in the group.

**Morphology:**

![Image of Isospora belli Immature Oocyst Containing One Sporoblast From CDC](image)

The stage found in freshly stool is the immature oocyst, the shape is elongated, ovoid & flask shape (like a bottle with short neck). It has two membranes outer and inner, they are hyaline, transparent & colorless and the tip of narrow end, there is micropyle. Within the oocyst there is sporoblast (zygote) with nucleus. After maturation in the feces within 2-3 days or in 2.5% potassium dichromate solution, the mature oocyst contain two spherical sporocysts, each with four crescent (banana shaped) sporozoites, which is the infective stage of the parasite.

The mature cyst of *I. belli*
**Life cycle of *I. belli***:

It includes 2 cycles: asexual or schizogony followed by sexual or gametogony cycle. All the two cycles take place in the intestinal epithelium cell of man.

Infection is by ingestion of food contaminated with mature oocyst, and by the action of digestive enzymes of GIT, the oocystic and sporocystic wall will rupture releasing the sporozoites, and the latter will enter the epithelium lining of small intestine and grow to become trophozoite. The nucleus and cytoplasm will divide into large numbers of merozoites which develop through the schizogony cycle again. After 2-3 cycles some of these merozoites will enter epithelium cell to form macrogametocytes (♀) and microgametocytes (♂) through the gametogony cycle. Only one gamete of male will fertilize one female gamete after fertilization, a zygote is formed within the lumen of S.I. and secret a wall around it to form immature oocyst that will pass with feces outside to be mature oocyst which is ready to infect another man, and the life cycle is completed.

Both asexual and sexual life cycles take place in man in the same host. The clinical course of Isosporiasis may be protected by repetition of intracellular asexual cycle inside the host.
The life cycle of *Isospora belli*
**Pathology & Clinical Features:**

In immunocompetent persons, there are mild gastrointestinal signs and symptoms which recover spontaneously within days or weeks. The disease is more serious in immunodeficient patients.

Infection causes acute, non-bloody diarrhea with fluid loss of 2-20 L/day (may contain mucus), with crampy abdominal pain, which can last for weeks and result in malabsorption and weight loss. In immunodepressed patients, and in infants and children, the diarrhea can be severe. Eosinophilia may be present (differently from other protozoan infections). *I. belli* is transmitted by fecal-oral contamination. This occurs more frequently under poor sanitation conditions. There is a 3-14 day incubation period between the ingestion of an infectious oocyst and onset of symptoms. After ingestion, the sporozoites invade epithelial cells in the small intestine which eventually destroy these cells. It has been suggested that the cause of Isosporiasis symptoms is toxin related but no toxin has been identified.

**Laboratory Diagnosis:**

Microscopic demonstration of the large typically shaped oocysts is the basis for diagnosis. Because the oocysts may be passed in small amounts and intermittently, repeated stool examinations and concentration procedures are recommended. If stool examinations are negative, examination of duodenal specimens by biopsy or string test (Enterotest) may be needed. The oocysts can be visualized on wet mounts by microscopy with bright-field, differential interference contrast (DIC), and epifluorescence. They can also be stained by modified acid-fast stain.

**Treatment:**

The antibiotic trimethoprim-sulfamethoxazole (TMP-SMZ) is used prophylactically in AIDS patients to prevent *Pneumocystis carinii* infections. *I. belli* infections can also be avoided with TMP-SMZ and even patients who are already infected usually respond well to this treatment.