

Enterobiasis and trichuriasis

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Disclosures

All topics are updated as new evidence becomes available and our [peer review process](#) is complete.

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INTRODUCTION — *Enterobius vermicularis* (pinworm) and *Trichuris trichiura* (whipworm) are two of the most common nematode infections worldwide [1].

ENTEROBIASIS — Enterobiasis occurs in both temperate and tropical climates; it is the most common helminthic infection in the United States and Western Europe [2]. Prevalence estimates suggest there are 40 million infected persons in the United States [3].

Humans are the only natural host. Infection occurs in all socioeconomic groups; transmission is most efficient when people are living in closed, crowded conditions, and is common within families. Enterobiasis is observed most frequently among school children aged 5 to 10 years; it is relatively uncommon in children <2 years old.

Life cycle and transmission — *E. vermicularis* has a simple life cycle ([figure 1](#)). The cycle begins with egg deposition by gravid adult female worms on the perianal folds. Autoinfection occurs by scratching the perianal area and transferring infective eggs to the mouth with contaminated hands. Person-to-person transmission can occur by eating food touched by contaminated hands or by handling contaminated clothes or bed linens. Infection may also be acquired via contact with environmental surfaces (curtains, carpeting) that are contaminated with eggs. In addition, eggs may become airborne, inhaled, and swallowed.

Following ingestion, eggs hatch and release larvae in the small intestine. The adult worms establish themselves in the gastrointestinal tract, mainly in the cecum and appendix. The time interval from ingestion of infective eggs to oviposition by the adult females is about one month. Each female worm can produce 10,000 or more eggs. The life span of the adults is two to three months. Most infected individuals have a few to several hundred adult worms. The worm burden is not distributed evenly among individuals; the one-quarter of the population that is most heavily infected has more than 90 percent of the total worm burden [4].

Gravid females migrate through the rectum onto the perianal skin to deposit eggs; this usually occurs at night. The larvae inside the eggs generally mature within four to six hours, resulting in infective eggs. The eggs begin to lose infectivity after one to two days under warm and dry conditions, but may survive more than two weeks in cooler, more humid environments.

Clinical manifestations — Most *Enterobius* infections are asymptomatic. The most common symptom of enterobiasis is perianal itching, also known as pruritus ani. This is caused by an inflammatory reaction to the presence of adult worms and eggs on the perianal skin and occurs predominantly at night. Scratching leads to lodging of eggs beneath the fingernails, facilitating subsequent autoinfection, and/or person-to-person transmission. Secondary bacterial infections can result if the excoriation is severe. Nocturnal pruritus can also lead to difficulty sleeping [5].

Occasionally the worm burden is so high that abdominal pain, nausea, and vomiting develop. Adult pinworms may be found in normal and inflamed appendices following surgical removal, but whether or not they cause appendicitis is still debated [6-10]. Eosinophilic enterocolitis can occur though peripheral eosinophilia is generally not observed [11,12].

In addition, adult worms can migrate to extraintestinal sites. Vulvovaginitis has been described, which can increase

susceptibility to urinary tract infections [13]. Involvement of other genitourinary sites has been described including salpingitis, oophoritis, cervical granuloma, and peritoneal inflammation. Enterobius infestation of the nasal mucosa has also been observed [14].

Diagnosis — Enterobiasis can be diagnosed via a "scotch tape" test, which is performed by sticking clear cellophane tape onto a wooden stick, and then doubling it over so that the sticky side points outwards. The stick with the tape should be pressed against the perianal skin, allowing eggs to adhere to the tape. These eggs can be placed onto a glass slide and visualized under a microscope. The diagnostic yield is greatest if the test is performed at night or first thing in the morning, prior to bathing.

Eggs are 50 by 25 micron and are asymmetrically flattened on one side, giving them a characteristic "bean-shaped" appearance (figure 2). Repeat testing may be necessary to increase the sensitivity.

Female adult worms may also be detected in the perianal area. They are white, pin-shaped, and 8 to 13 mm long.

Stool examination is not necessary since worms and eggs are not passed in stool.

Treatment — Treatment of enterobiasis consists of anthelmintic therapy with [albendazole](#) (400 mg orally once; repeat in two weeks) or [mebendazole](#) (100 mg orally once; repeat in two weeks) [15-18]. A single dose results in relatively high cure rates, although a second dose repeated at two weeks achieves a cure rate close to 100 percent and helps prevent recurrence due to reinfection [8,19]. (See '[Life cycle and transmission](#)' above.)

Reinfection is common, despite effective therapy. Therefore, simultaneous treatment of the entire household is warranted given high transmission rates among families. In addition, all bedding and clothes should be washed. Hygienic measures, such as clipping of fingernails, frequent handwashing, and baths, are also helpful for reducing reinfection and spread of infection.

[Pyrantel pamoate](#) (11 mg/kg; maximum 1 g) is an acceptable alternative agent to the benzimidazoles, with efficacy approximately 90 percent. Adverse effects include anorexia, nausea, vomiting, abdominal cramps, and diarrhea. It is also associated with neurotoxic effects and transient increases in hepatic enzymes.

[Ivermectin](#) has efficacy against *E. vermicularis*, but is not generally used for this indication [20,21]. In one study, two doses of ivermectin 200 mcg/kg given at an interval of 10 days resulted in a cure of 100 percent for enterobiasis [22].

Piperazine is no longer used because of lower efficacy and increased toxicity compared with the benzimidazoles.

Pregnancy — Treatment of enterobiasis in pregnant women should be reserved for patients with significant symptoms. [Pyrantel pamoate](#) is favored over [mebendazole](#) or [albendazole](#) for treatment of symptomatic enterobiasis in pregnant women [23,24].

In one study of 192 pregnant women exposed to [mebendazole](#) during pregnancy (72 percent during the first trimester), no increase in major malformations was observed compared with matched controls, although there were more elective terminations in the group receiving mebendazole [25].

TRICHURIASIS — Trichuriasis occurs most commonly in tropical climates. It is estimated that approximately one-quarter of the world population carries this parasite [26]. In communities where Trichuriasis is endemic, infection may be present in more than 90 percent of individuals, but the majority of the total worm burden is generally carried by fewer than 10 percent [27]. *T. trichiura* is frequently observed in association with other geohelminths such as *Ascaris lumbricoides*, since these pathogens thrive under similar conditions.

Transmission of trichuriasis is associated with poor hygiene. Individuals of all ages can become infected. Children are particularly vulnerable to infection because of their high exposure risk and because partial protective immunity is thought to develop with age.

Life cycle and transmission — The life cycle for trichuriasis begins with passage of unembryonated eggs in the stool (figure 3). In the soil, the eggs embryonate and become infective in 15 to 30 days. After ingestion via food or hands contaminated with soil, the eggs hatch in the small intestine and release larvae that mature into adult worms, which become established in the cecum and ascending colon after two to three months. In heavy infections, worms may also be found in the distal colon and rectum [26].

The adults measure approximately 4 cm in length. The thin end is embedded in the bowel mucosa and the thick end is visible within the bowel lumen. The females begin to produce eggs 60 to 70 days after infection and shed 3000 to 20,000 eggs per day. The life span of the adults is one to three years.

Reinfection is common following therapy in endemic areas. Adequate disposal of human feces and good sanitary conditions can interrupt transmission. Good personal hygiene and careful washing of vegetables and fruits grown in contaminated areas is also important.

Clinical manifestations — Most infections with *T. trichiura* are asymptomatic. Clinical symptoms are more frequent with moderate to heavy infections. Stools can be loose and often contain mucus and/or blood. Nocturnal stooling is common. Colitis and dysentery occur most frequently among individuals with >200 worms, and secondary anemia may be observed. Infected individuals may have a peripheral eosinophilia of up to 15 percent.

Rectal prolapse is the most common clinical finding. This occurs primarily in the setting of heavy infection, and embedded worms may be directly visualized in the mucosa of the inflamed rectum. Pica and finger clubbing are other potential clues to the diagnosis.

Children who are heavily infected may have impaired growth and/or cognition [28,29]. However, it can be difficult to quantify the role of trichuriasis in isolation from comorbidities and other social factors.

Diagnosis — The diagnosis of trichuriasis is made by stool examination for eggs (figure 4). The eggs are 50 by 20 microns and have a characteristic barrel shape with smooth thick wall, and a hyaline plug at each end. The Kato-Katz technique can be used to quantify egg numbers, which tends to correlate with the adult worm burden [30,31].

Proctoscopy or colonoscopy can be performed and frequently demonstrates adult worms protruding from the bowel mucosa (figure 5). The adult worm is shaped like a whip. The posterior part of the worm is wider and looks like the whip handle, and the anterior part is long and thin.

Treatment — Treatment of trichuriasis consists of anthelmintic therapy with [mebendazole](#) (100 mg orally twice daily for three days; 70 to >90 percent cure) [8,32] or [albendazole](#) (400 mg orally once daily for three days; 80 percent cure) [33]. The outcomes for three days of therapy are comparable, and three days of therapy are favored over single dose therapy [34,35]. For patients with heavy infection (at least 1000 *Trichuris* eggs/g feces), treatment regimens of five to seven days may be warranted [36].

[Ivermectin](#) has some activity against trichuriasis, though is not as effective as [mebendazole](#) or [albendazole](#) for individual therapy [20,21,37]. There is limited data on [nitazoxanide](#) for treatment of trichuriasis [38].

Mass community therapy for preschool and school-aged children is being instituted in many developing areas. The goal of this therapy is to treat children for a variety of geohelminths, including trichuriasis. Treatment decreases symptoms and developmental impairment in children [39]. By targeting the most heavily infected age group, transmission to the rest of the population is also reduced.

For mass therapy at the community level, treatment with [ivermectin](#) combined with [albendazole](#) or [mebendazole](#) (single dose) appears to improve therapeutic outcomes over treatment with [albendazole](#) or [mebendazole](#) alone [40-43]. Among children with trichuriasis in the Philippines, the cure rate was significantly higher with the combination of [albendazole](#) (single dose) and [ivermectin](#) than with monotherapy (65 percent cure rate for combination therapy versus 32 percent cure rate for [albendazole](#) alone and 35 percent cure rate for [ivermectin](#) alone) [40]. Other studies have demonstrated that mass treatment with [mebendazole](#) (500 mg single dose) results in cure rates of 40 to 75 percent [44-46]. [Ivermectin](#) may reduce infections with trichuriasis as well as provide long-term control of onchocerciasis in endemic areas [42].

Pregnancy — [Mebendazole](#) and [albendazole](#) should be avoided during pregnancy, particularly during the first trimester. The risks of administering treatment to pregnant women with trichuriasis must be weighed against the risks of delaying treatment. Therapy for patients with trichuriasis in the absence of significant symptoms can be deferred until after delivery.

INFORMATION FOR PATIENTS — UpToDate offers two types of patient education materials, “The Basics” and “Beyond the Basics.” The Basics patient education pieces are written in plain language, at the 5th to 6th grade

reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "[Patient information: Pinworms \(The Basics\)](#)")

SUMMARY AND RECOMMENDATIONS

- *Enterobius vermicularis* (pinworm) and *Trichuris trichiura* (whipworm) are two of the most common nematode infections worldwide. Enterobiasis occurs in both temperate and tropical climates; it is the most common helminthic infection in the United States and Western Europe. Trichuriasis occurs most commonly in tropical climates. (See '[Introduction](#)' above.)

Enterobiasis

- The life cycle of *Enterobius* begins with egg deposition by gravid adult female worms on the perianal folds ([figure 1](#)). Autoinfection occurs by scratching the perianal area and transferring infective eggs to the mouth with contaminated hands. Person-to-person transmission can occur by eating food touched by contaminated hands or by handling contaminated clothes or bed linens. (See '[Life cycle and transmission](#)' above.)
- Most *Enterobius* infections are asymptomatic. The most common symptom of enterobiasis is perianal itching, which occurs predominantly at night. Occasionally the worm burden is so high that abdominal pain, nausea, and vomiting develop. Enterobiasis can be diagnosed via examination of cellophane tape for eggs after pressing to the perianal skin ([figure 2](#)). Stool examination is not necessary since worms and eggs are not passed in stool. (See '[Clinical manifestations](#)' above and '[Diagnosis](#)' above.)
- We suggest treatment of enterobiasis with [albendazole](#) or [mebendazole](#) (**Grade 2C**); dosing is outlined above. Simultaneous treatment of the entire household is warranted, given high transmission rates among families. (See '[Treatment](#)' above.)

Trichuriasis

- The life cycle for trichuriasis begins with passage of unembryonated eggs in the stool, which become infective in 15 to 30 days ([figure 3](#)). After ingestion via food or hands contaminated with soil, the eggs hatch and release larvae that mature into adult worms which become established in the colon after two to three months. (See '[Life cycle and transmission](#)' above.)
- Most infections with *T. trichiura* are asymptomatic. Rectal prolapse is the most common clinical finding and occurs primarily in the setting of heavy infection. Stools can be loose and often contain mucus and/or blood. Nocturnal stooling is common. The diagnosis of trichuriasis is made by stool examination for eggs ([figure 4](#)). (See '[Clinical manifestations](#)' above.)
- We suggest treatment of trichuriasis with [mebendazole](#) (three days) or [albendazole](#) (three days) (**Grade 2B**); dosing is outlined above. Mass community therapy for preschool and school aged children is being instituted in many developing areas. (See '[Treatment](#)' above.)

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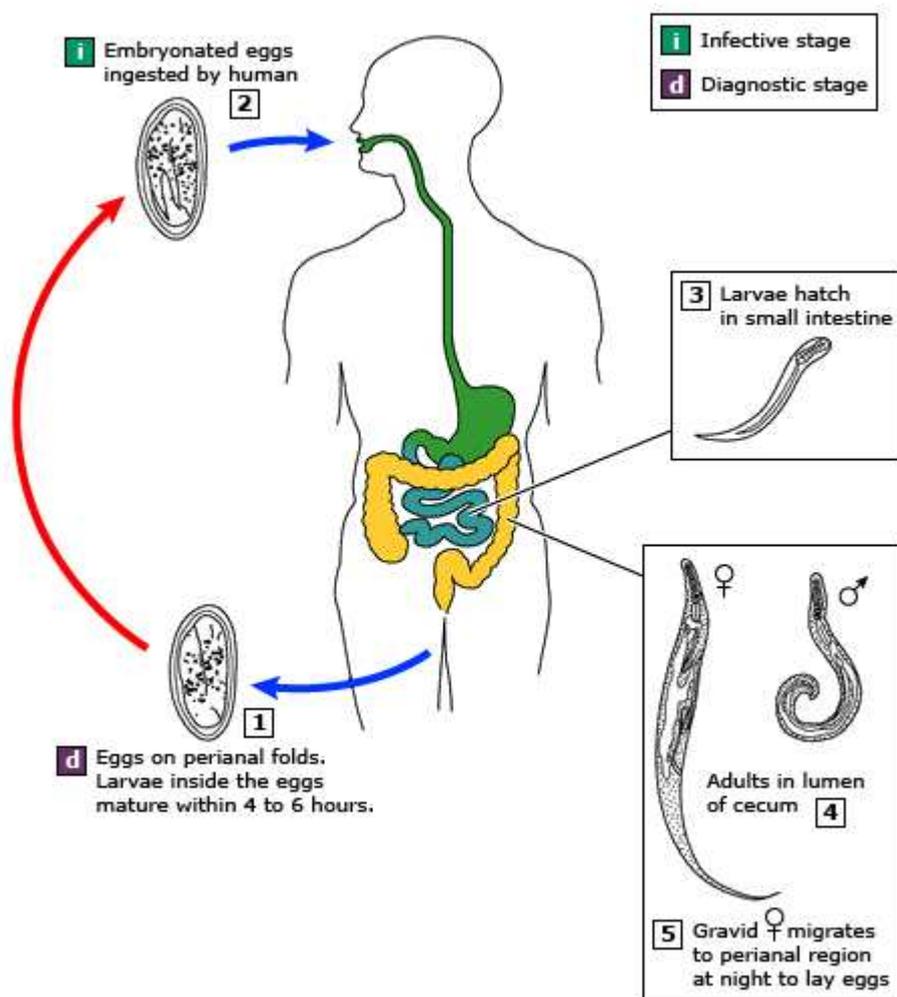
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GRAPHICS

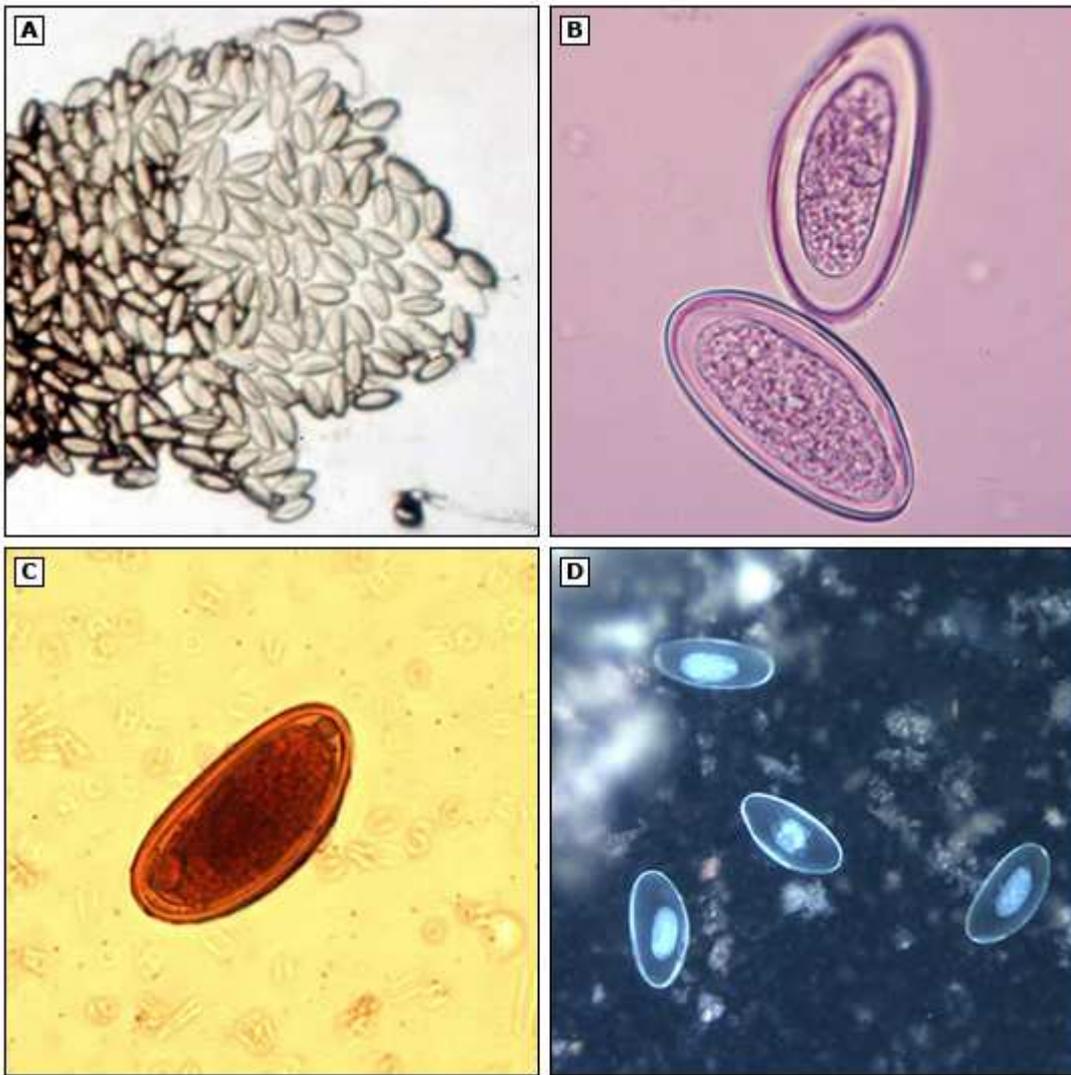
Enterobiasis life cycle



Eggs are deposited on perianal folds **(1)**. Self-infection occurs by transferring infective eggs to the mouth with hands that have scratched the perianal area **(2)**. Person-to-person transmission can also occur through handling of contaminated clothes or bed linens. Enterobiasis may also be acquired through surfaces in the environment that are contaminated with pinworm eggs (eg, curtains, carpeting). Some small number of eggs may become airborne and inhaled. These would be swallowed and follow the same development as ingested eggs. Following ingestion of infective eggs, the larvae hatch in the small intestine **(3)** and the adults establish themselves in the colon **(4)**. The time interval from ingestion of infective eggs to oviposition by the adult females is about one month. The life span of the adults is about two months. Gravid females migrate nocturnally outside the anus and oviposit while crawling on the skin of the perianal area **(5)**. The larvae contained inside the eggs develop (the eggs become infective) in four to six hours under optimal conditions **(1)**. Retroinfection, or the migration of newly hatched larvae from the anal skin back into the rectum, may occur but the frequency with which this happens is unknown.

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Enterobius eggs



(A) Eggs of *E. vermicularis* in a cellulose-tape preparation.

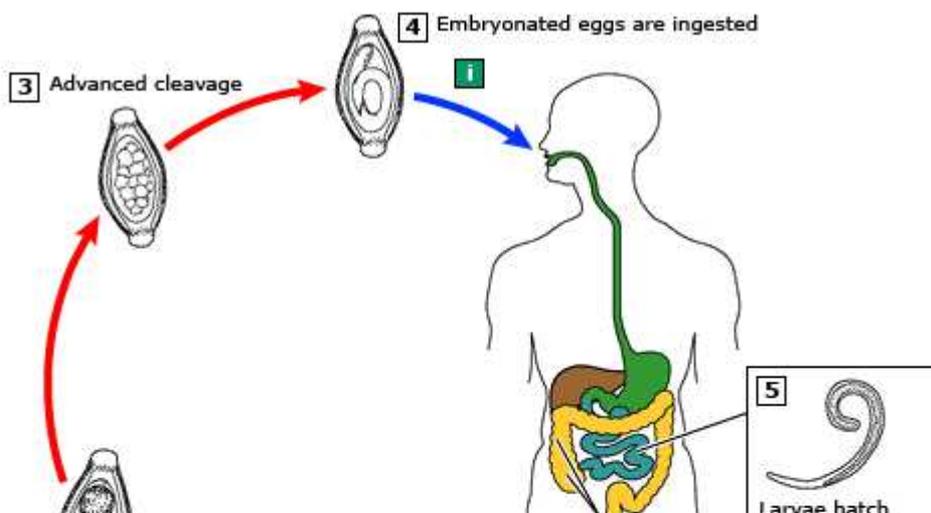
(B) Eggs of *E. vermicularis* in a wet mount.

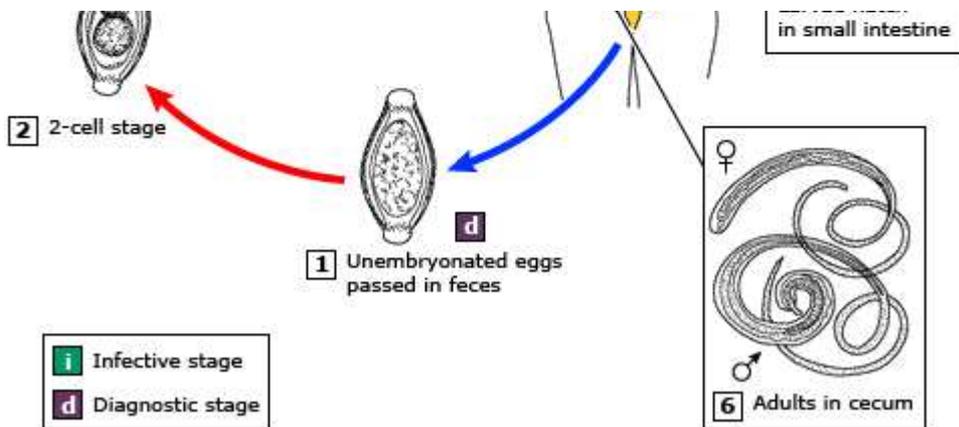
(C) Egg of *E. vermicularis* in an iodine-stained wet mount from a formalin concentrate.

(D) Eggs of *E. vermicularis* viewed under UV microscopy.

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Trichuriasis life cycle

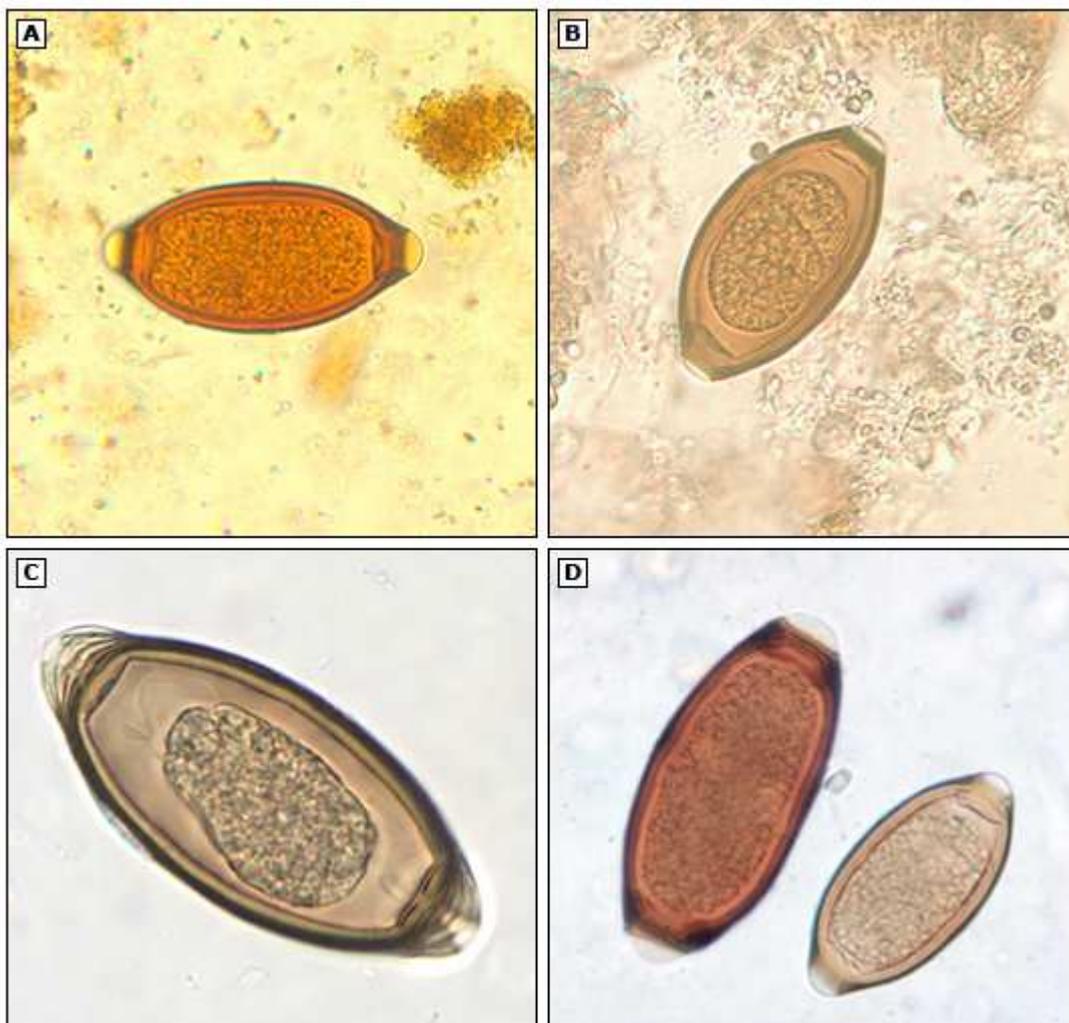




The unembryonated eggs are passed with the stool (1). In the soil, the eggs develop into a two-cell stage (2), an advanced cleavage stage (3), and then they embryonate (4); eggs become infective in 15 to 30 days. After ingestion (soil-contaminated hands or food), the eggs hatch in the small intestine, and release larvae (5) that mature and establish themselves as adults in the colon (6). The adult worms (approximately 4 cm in length) live in the cecum and ascending colon. The adult worms are fixed in that location, with the anterior portions threaded into the mucosa. The females begin to oviposit 60 to 70 days after infection. Female worms in the cecum shed between 3000 and 20,000 eggs per day. The life span of the adults is about one year.

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Trichuriasis eggs



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- (A) Egg of *T. trichiura* in an iodine-stained wet mount.
(B) Egg of *T. trichiura* in an unstained wet mount.
(C) Egg of *T. trichiura* in an unstained wet mount.
(D) Two eggs of *T. trichiura*, showing the variability in size of the species.
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Trichuriasis scope



Image showing the posterior end of an adult *T. trichiura*, taken during a colonoscopy.

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