


## Taeniasis

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Leticia Fadda Melo Oliveira<sup>1</sup>, Larissa de Oliveira Mendes Simões<sup>2</sup>, Amanda Luísa Motti de Oliveira Elias<sup>3</sup>, Janaina Sousa Campos Alvarenga<sup>4</sup> and Ângela Cardoso de Alvarenga<sup>5</sup>

### ABSTRACT

**Introduction:** The chapter deals with taeniasis, an infection of the small intestine caused by two cestoids, *Taenia solium* and *Taenia saginata*, popularly known as tapeworms or solitaria. Belonging to the class Cestoda, these hermaphrodite parasites have dorsoventrally flattened bodies, devoid of a general cavity and digestive system. **Objectives:** The focus of the chapter is to provide an in-depth understanding of the clinical, epidemiological, and control strategies related to taeniasis. **Etiologic Agent:** In man, the definitive host, taeniasis is caused by the presence of the adult form of these parasites in the small intestine. **Evolutionary forms:** Throughout the biological cycle, both species go through three evolutionary forms: egg, cysticercus, and adult worm. The cysticercus, a larval form, reaches up to 12 mm in length after 4 months of infection. **Form of contamination of human beings:** Taeniasis, caused by *Taenia solium* and *Taenia saginata* is a parasitosis that exclusively impacts humans, and its transmission is associated with the consumption of meat contaminated with cysticerci, the larval forms of the parasite. Infection occurs when individuals ingest contaminated beef or pork, especially if eaten raw or undercooked. **Biological cycle:** The biological cycle is similar for both species, differing in intermediate hosts. Parasitized humans eliminate pregnant proglottids into the environment, releasing eggs that contaminate soil. Pigs and cattle ingest these eggs, developing cysticerci in the tissues. Human infection occurs through the consumption of contaminated meat. **Clinical manifestations:** Although the popular designation suggests a single tapeworm, individuals may be infected by more than one, including different species. Most are asymptomatic, but gastrointestinal symptoms, allergies, bleeding spots, and even parasitic appendicitis can occur. **Diagnosis:** Diagnosis requires laboratory tests, such as screening for proglottids and eggs in the stool. **Treatment:** The main treatment is Praziquantel, given orally as a single dose. Other medications, such as Mebendazole and Albendazole, are also options. **Prophylaxis:** Preventive measures include treatment of carriers, basic sanitation, care in raising animals for slaughter, health education, modernization of pig farming, and rigorous inspection of slaughterhouses. Specific strategies, such as avoiding coprophagic behavior in pigs, have been shown to be effective. **Conclusion:** The chapter provides a comprehensive overview of taeniasis, highlighting its clinical complexity, epidemiological factors, and control approaches. Understanding these aspects is crucial for the effective confrontation of this parasitosis, especially in regions where sanitary and socioeconomic conditions contribute to its dissemination.

**Keywords:** Intestinal parasitosis, *Taenia taeniasis*, *Taenia solium*, *Taenia saginata*, Parasitic prophylaxis.

<sup>1</sup> Medical Student at PUC Minas.

<sup>2</sup> Medical Student at PUC Minas.

<sup>3</sup> Medical Student at PUC Minas.

<sup>4</sup> Dr. in Parasitology, Professor of Medicine at PUC Minas.

<sup>5</sup> Dr. in Parasitology, Professor of Medicine at the Faculty of Medical Sciences MG

## INTRODUCTION

The class Cestoda encompasses parasites of vertebrate animals, hermaphrodites, of different sizes. These organisms have a dorsoventrally flattened body, equipped with adhesion organs at the anterior end, and lack a general cavity and digestive system. Among the cestodes that commonly parasitize humans, the species *Taenia solium* and *Taenia saginata*, popularly known as tapeworms or solitaria, stand out.

Taeniasis emerges as a serious public health challenge in countries with precarious conditions, encompassing health, socioeconomic and cultural aspects that play a crucial role in the transmission of this disease. It is estimated that approximately 77 million people are parasitized by *T. saginata* worldwide, with 32 million in Africa, 11 million in Asia (excluding Russia), 2 million in South America, and 1 million in North America. In Brazil, data on the prevalence of this parasitosis are imprecise, scarce and generally derive from specific initiatives carried out by health professionals.

Taeniasis is an infection of the small intestine caused by *T. solium* or *T. saginata*, whose intermediate hosts are pigs (pigs) and cattle (cattle and cows), respectively. The places where the highest rates of *T. saginata* infection are recorded are Latin America, Central America, Africa and the Middle East. *T. solium*, on the other hand, is more commonly found in Latin America. The occurrence of the disease is related to poor hygiene conditions, lack of basic sanitation and extensive animal husbandry, emphasizing clandestine slaughterhouses. Cultural and religious factors can also increase exposure to taeniasis, such as cuisines that use raw meat dishes.

## ETHIOLOGICAL AGENT

In humans, the definitive host of *T. solium* and *T. saginata*, taeniasis, popularly known as solitary, is caused by the presence of the adult form of the parasites in the small intestine.

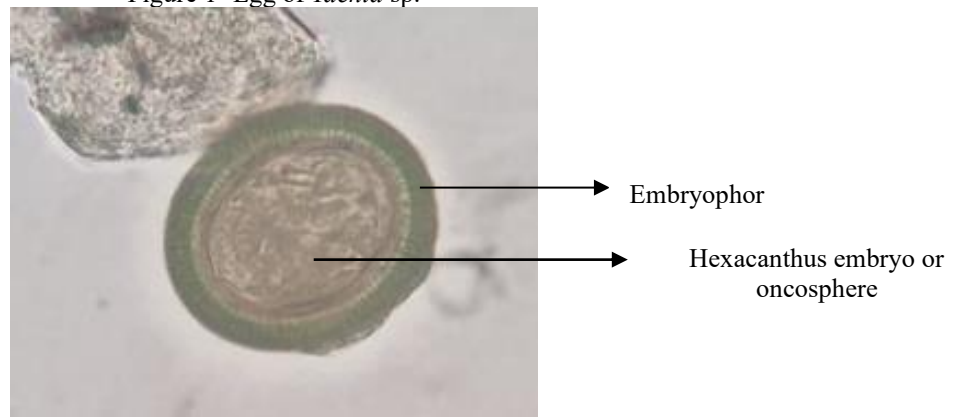
## EVOLUTIONARY WAYS

Throughout the biological cycle, both species of *Taenia* go through 3 evolutionary forms.

**Egg** - microscopic and spherical, measures about 30µm in diameter. The simple observation of eggs in fecal samples does not allow the differentiation of species. They have a protective shell called embryophore, composed of pyramidal blocks of chitin, joined by a protein substance, which gives them environmental resistance for up to 12 months. Internally, the eggs contain the hexacanthus embryo or oncosphere, equipped with three pairs of hooks and double membrane.

Figure 1 shows the structure of an egg of *Taenia* sp.

Figure 1- Egg of *Taenia* sp.



Source: Personal collection.

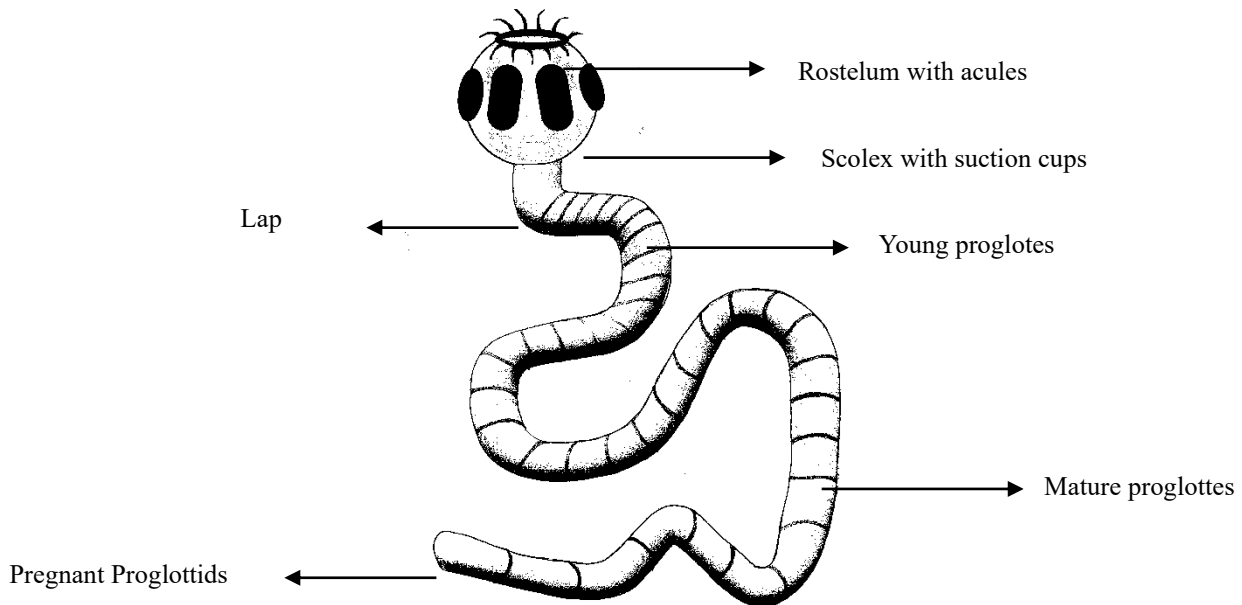
**Cysticator** – corresponds to the larval form of the helminth, which can reach up to 12 mm in length after 4 months of infection, being visible to the naked eye. The cysticercus consists of a transparent vesicle with clear fluid inside, containing the scolex and cervix. The wall of the cysticercus vesicle is composed of three membranes: cuticular or external, cellular or intermediate, and reticular or internal.

**Adult worm - *T. solium*** measures 3 to 5 meters in length. The scolex ("head") measures from 1 to 2 mm in size and is provided with 4 suction cups, a rostrum armed with a double crown of hooks, known as aculeum, which allow the worm to attach to the intestinal wall. Below the scolex is located the cervix ("neck"), which is the germinal center of the worm, that is, the parasite's growth zone, where the cells of the parenchyma are actively multiplying to give rise to the proglottids, which together will form the strobilus ("body"). Newly formed proglottids are called "young." As the proglottis moves away from the scolex, it matures, with the formation of the reproductive system, and is called mature proglottis. Each one demonstrates reproductive autonomy, that is, it contains a male and female reproductive system internally, and reproduction takes place within each of these compartments. After the reproduction process, they become full of eggs, and are called pregnant proglottids. These measure approximately 1 cm long by 0.6 cm wide and have about 50,000 eggs inside. A human being infected with *T. solium* releases 3 to 6 pregnant proglottids daily, always mixed into the fecal bolus.

*T. saginata* can reach 9 meters in length and its scolex has only 4 suckers. Each pregnant proglottis of this species has about 80,000 eggs inside it and the infected individual can release up to 9 pregnant proglottids daily, and this release can happen independently of the fecal bolus. Because they have a well-developed musculature, the proglottids of *T. saginata* can actively exit through the anal orifice and be found in the undergarments and clothing and bed.

Figure 2 shows a schematic drawing of *Taenia solium*.

Figure 2- Schematic drawing of *Taenia solium*.



Source: Prepared by the authors.

## FORM OF CONTAMINATION OF HUMAN BEINGS

Taeniasis, caused by *the species Taenia solium* and *Taenia saginata*, is a parasitosis that affects only humans and its transmission is associated exclusively with the consumption of meat contaminated with cysticerci, the larval forms of the parasite. Infection occurs when individuals ingest contaminated, raw, or undercooked beef or pork. And how do these animals get contaminated? See below for the description of the biological cycle.

## BIOLOGICAL CYCLE

The biological cycle is the same for *Taenia solium* and *Taenia saginata*, differing only in the species that parasitizes each of the intermediate hosts. Parasitized human individuals eliminate pregnant proglottids full of eggs to the external environment, especially in regions with poor conditions and basic sanitation or when individuals have the habit of defecating in the open. In the environment, proglottids rupture due to muscle contraction or decomposition of their structures, releasing thousands of eggs into the soil. In humid environments protected from intense sunlight, the eggs maintain a long viability, remaining infectious for months.

An appropriate intermediate host (pig for *T. solium* and bovine for *T. saginata*) ingests these eggs. As they pass through the stomachs of these animals, they undergo the action of pepsin, which acts on the cementing substance of the chitin blocks. In the gut, the oncospheres are activated by bile salts, which play a crucial role in their release. Once activated, the oncospheres break free from the embryophore and move towards the villi, where they penetrate the venules, reach the veins and mesenteric lymphatics, and are transported to all the organs and tissues of these animals.



Subsequently, they pass through the vessel wall, settling in the surrounding tissues. Oncospheres develop into cysticerci in any soft tissue, preferring those with higher oxygenation. Inside the tissues, each oncosphere transforms into a small, slender, translucent cysticercus that grows and at the end of four or five months of infection, reaches 12 mm in length. In the tissues of these animals they remain viable for a few months. Cattle inadvertently ingest eggs through the consumption of contaminated water or the presence of eggs in the pasture. The pig, when raised freely, feeds directly on feces, facilitating contamination.

Human infection occurs by ingesting raw or undercooked meat from infected pork or beef. The ingested cysticercus undergoes the action of gastric juice, evaginates and attaches itself to the mucosa of the human small intestine by means of the scolex, transforming into an adult tapeworm in the period of 60 days, when the elimination of pregnant proglottids begins. *T. solium* has a lifespan of three years, while *T. saginata* can live up to ten years. During parasitism, several pregnant proglottids detach from the strobilus daily, while the cervix generates new proglottids, keeping the parasite in continuous growth.

## CLINICAL MANIFESTATIONS

Although the popular designation of "solitary" suggests that the host harbors only one parasite, in practice, it is observed that individuals can be infected by more than one tapeworm, including different species.

Most infected people remain asymptomatic. Other oligosymptomatic Due to the long period of parasitism, worms can trigger allergic toxic phenomena due to the substances excreted, cause hemorrhagic points by attachment to the mucosa, cause damage to the epithelium and generate inflammation with the presence of inflammatory cells, in addition to hypo or hypersecretion of mucus. The rapid growth of the parasite demands a significant nutritional supplement, resulting in a competition with the host. Symptoms such as dizziness, asthenia, increased appetite, nausea, vomiting, bloating, pain of varying intensity in different regions of the abdomen, and weight loss may be observed. Although rare, cases of penetration of a proglottis into the appendix, generating parasitic appendicitis, have been documented in patients parasitized by *T. saginata*.

## DIAGNOSIS

The diagnosis of taeniasis cannot be entirely clinical, requiring complementary tests, except in cases in which the patient observes proglottids.

The laboratory diagnosis is made from the search for proglottids and eggs in the feces, in addition to the analysis of the presence of eggs also in the perianal region. Among the egg search methods, spontaneous sedimentation and centrifugal-flotation can be used. The screening technique



can help the finding of proglottids, since it is based on passing the feces through a sieve in running water, with the proglottids being retained during the process. Another method used is Graham's, which consists of pressing an adhesive tape on the perianal region, with subsequent fixation of it on a slide, followed by direct observation under an optical microscope.

## TREATMENT

Treatment consists of oral administration of Praziquantel as a single dose, usually 5 to 10 mg per kg of body weight. The mechanism of action is based on changes in the tapeworm integument, which loses adhesion to the intestine and is expelled through intestinal peristaltic movements.

Other medications may also be used in the treatment of taeniasis, such as Mebendazole 200mg, 2 times a day, for 3 days, orally, or Albendazole, 400mg a day, for 3 days.

## PROFILAXIA

Preventive measures for this parasitosis include: the treatment of patients with taeniasis; the implementation of sewage systems or septic tanks; sewage treatment, avoiding contamination of rivers, sources of water for animals; care in raising animals (pigs and cattle) for slaughter; the promotion of health education; encouraging and supporting the modernization of pig farming; the fight against clandestine slaughter; and rigorous inspection of slaughterhouses, including confiscation of parasitized carcasses.

Considering the natural propensity of pigs to coprophagic behavior, control strategies aimed at avoiding the contact of these animals with human feces are effective.



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