



# *Taenia saginata* / *Cysticercus bovis*

Scientific names: *Taenia saginata* /  
metacestode of *Taenia saginata*  
English name: "Tapeworm", "Beef tapeworm"  
Helminths, phylum Plathelminths (flatworms)  
Parasite

## Nature and sources of *Taenia saginata*

### Main microbiological characteristics



TSAGINATA scolex - anofel

*Taenia saginata* is one of two agents responsible for human taeniasis, the other being *Taenia solium*. It is a flatworm (Class Cestoda, Order Cyclophyllidea, Family Taeniidae) with a two-stage life cycle: adult (in the definitive host<sup>(1)</sup>) and larval (in the intermediate host<sup>(2)</sup>). It lives in the human small intestine, usually just a single specimen at a time. It is in the form of a long segmented ribbon up to several metres in length (4 to 10 m), yellowish-white, thin at its front end and widening gradually toward the rear end. The adult worm consists of three parts: the scolex («head»), which has the appearance of a small bulge 1 to 2 mm in diameter, with four suckers and no hooks; the neck, a tapered portion joining the scolex to the rest of the body and ending with the strobila, made up of a chain of segments or rings called «proglottids» each measuring between 5 and 20 mm long. The older, mature proglottids towards the end of the strobila are just sacs containing from 50,000 to 80,000 embryonated eggs or «embryophores».

Humans, the only known definitive host of *T. saginata*, are the only source of dissemination of embryophores in the environment. Eggs ingested by cattle (the intermediate hosts) hatch in the digestive tract, releasing the hexacanth embryos<sup>(3)</sup> (oncospheres). These pass through the intestinal mucosa and migrate *via* general circulation to the skeletal muscles and heart, where they develop into cysticerci larvae (metacestodes) called

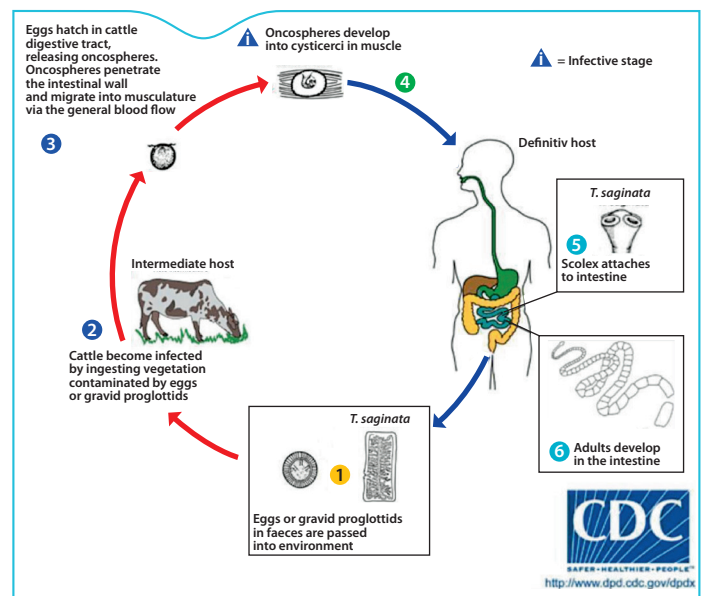


Figure 1. Biological cycle of *Taenia saginata* (adapted from a diagram presented by the CDC)

*Cysticercus bovis*, which can contaminate humans after maturing for about 10 weeks. Once ingested, they release the scolex, then the tapeworm develops in the human small intestine and in 3 months, mature rings actively migrate through the anal sphincter. The lifespan of cysticerci is variable, some degenerate in 9 months, but others may remain viable for several years.

## Sources of the hazard

The source of the hazard to humans has its origin in the cysticerci contained in beef. In Europe, the prevalence of bovine cysticercosis is thought to vary between 0.007% and 6.8%.

For cattle, the only source of the hazard is infected humans spreading the embryophores in the environment. Up to 500,000 eggs can be released per day, and are likely to remain viable for weeks or even months in the external environment. The embryophores found in sewage sludge are in principle inactivated by the various treatment processes.

(1) Definitive host: host that harbours the adult parasite.

(2) Intermediate host: host that harbours the larval form of the parasite.

(3) Hexacanth embryos: larvae with six hooks.

The environmental risk therefore comes from the lack or poor quality of sanitation, dispersion of septic tank sludge on pastures or fields, or defecation of hikers or campers. In addition, embryophores can be dispersed in the environment when rivers overflow.

## Transmission routes

Taeniasis caused by *T. saginata* is defined as a zoonosis. Consumption of raw or undercooked beef containing cysticerci is the only route of transmission to humans.

### Recommendations for primary production

- Compliance with current regulations and recommendations for the treatment and spreading of sewage sludge, as well as the use of treated wastewater for irrigation and watering.
- Prohibition of the use of human fertilizers.
- Farmers should be informed of how embryophores are disseminated in the environment, to enable them to implement self-correction measures for the risk factors (proper maintenance of sanitation facilities).

## Human food-borne illness

### Nature of the disease

The majority of cases are strictly asymptomatic. The infection is most often recognised by the presence of proglottids in faeces and sometimes by perianal discomfort when releasing proglottids. (table 1)

**Susceptible population group(s)<sup>(4)</sup>:** There is no evidence to date to suggest that there is a population at higher risk of infection or complications.

### Dose-effect<sup>(5)</sup> and dose-response<sup>(6)</sup> relationships

There are no data in the literature regarding the minimal infectious dose of cysticerci of *T. saginata*. In theory, one cysticercus larva may be sufficient to infect humans.

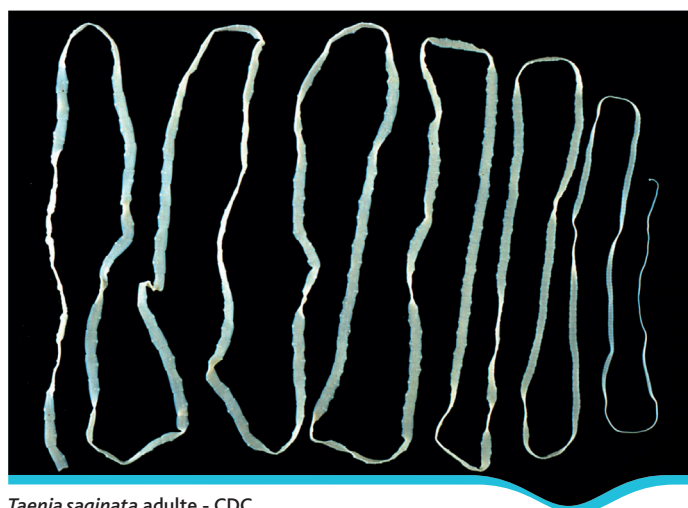
## Epidemiology

### Monitoring system:

As taeniasis caused by *T. saginata* is not a notifiable disease, there is no comprehensive active monitoring in humans.

### Prevalence:

It has only been possible to assess the annual incidence indirectly. Based on annual sales figures for taeniocides it was assessed at 0.7% of the general population in 1976. Work by the French Institute for Public Health Surveillance (InVS) in 2000-2002 estimated the average annual number of cases at 65,000 from data on reimbursement of niclosamide by the National Health Insurance Fund for Salaried Employees (CNAMTS). The



*Taenia saginata* adulte - CDC

average number of hospitalised cases was estimated at between 14 and 60 from data from the programme for medicalisation of information systems (PMSI) and there were no fatalities according to data from CépîDc-Inserm.

## Role of foods

Consumption of raw or undercooked beef from skeletal muscle is the source of contamination.

## Inactivation treatments in industrial environments

Table 2. Inactivation treatments in industrial environments

Heat	Cold
Cysticerci are killed by heating meat to an internal temperature of at least 60°C for several minutes.	Cysticerci are inactivated by freezing, at least equivalent to freezing to an internal temperature of -10°C for 10 days or -15°C for 6 days.
Ionisation	Other processes
A dose of 0.3 to 0.4 kGy may inactivate 100% of cysticerci.	The infectivity of cysticerci is inhibited by salting: 20 days covered by salt for cuts weighing 2.5 Kg.

(4) Susceptible population group: people with a higher than average probability of developing symptoms of the disease, or severe forms of the disease, after exposure to a foodborne hazard [definition used in ANSES data sheets].

(5) Relationship between the dose (the quantity of microbial cells ingested during a meal) and the effect on an individual.

(6) For a given effect, the relationship between the dose and the response, i.e., the probability of this effect appearing in the population.

Table 1. Characteristics of the disease

Mean incubation period (worm maturation phase)	Target population	Main symptoms	Duration of symptoms	Duration of the contagious period (shedding)	Complications
2-3 months	All consumers of beef	<ul style="list-style-type: none"> <li>• Active emission of proglottids apart from defecation</li> <li>• Epigastralgia and other abdominal pain</li> <li>• Nausea</li> <li>• Weight loss</li> <li>• Changes in eating behaviour: loss of appetite or bulimia</li> <li>• Mood and character disorders</li> <li>• Manifestations of skin allergies</li> </ul>	Until treatment for taeniasis	Until treatment for taeniasis	Appendicitis

## Monitoring in foods

In accordance with Regulation (EC) No 854/2004<sup>(7)</sup>, during the *post-mortem* inspection of carcasses at the slaughterhouse, the minimum requirements for screening for cysticercosis in cattle over 6 weeks are: visual inspection and palpation of the tongue and oesophagus, visual inspection of the diaphragm, visual inspection before and after incision of the external and internal masseters and heart. Because of the wide dispersion of cysticerci in cattle carcasses and their sometimes modified appearance, this screening method has poor sensitivity, underestimating the prevalence by a factor ranging from 3 to 10.

The Order of 18 December 2009<sup>(8)</sup> stipulates that for any carcass in which a cysticercus or lesion suggestive of cysticercosis is found, a thorough examination should be carried out. If more than one lesion per square decimetre is found, in any location whatsoever, the carcass (including head, oesophagus and heart) is withdrawn from human consumption. When there are fewer lesions, the damaged part is seized and the remainder of the carcass is sanitised (carcass frozen to -10°C internal temperature for a minimum of 10 days).

### Recommendations to operators

- Prohibition of the sale of beef from non-inspected carcasses.
- If carcasses infested with cysticerci are detected during health inspection at the slaughterhouse, operators must convey the information to farmers as part of food chain information (FCI). The farmers must then give this information to the slaughterhouse when other cattle are slaughtered.

## Domestic hygiene

### Recommendations to consumers

- Cook beef until well-done.
- The prior freezing in a domestic freezer (-10°C for 10 days or -15°C for 6 days) of meat intended to be eaten raw or undercooked is a good means of prevention.

## Links

### General references

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- Dorny P., Praet N. *Taenia saginata* in Europe. Vet. Parasitol. 2007; 149: 22–24.
- FAO/WHO. Codex Committee on Food Hygiene. 43<sup>rd</sup> session. Proposed Draft Guidelines for Control of Specific Zoonotic Parasites in Meat: *Trichinella spiralis* and *Cysticercus bovis*. Miami, United States, from 5 to 9 December 2011. ([ftp://ftp.fao.org/codex/Meetings/CCFH/ccfh43/fh43\\_06f.pdf](ftp://ftp.fao.org/codex/Meetings/CCFH/ccfh43/fh43_06f.pdf)).
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- WHO/FAO/OIE. Guidelines for the Surveillance, Prevention and Control of Taeniosis/Cysticercosis. 2005. (<http://www.oie.int/doc/ged/D11245.pdf>).

### Useful links

- EU Reference Laboratory for parasites: Istituto Superiore di Sanità (ISS) I-00161, Rome – Italy (<http://www.iss.it/crlp/index.php>)
- National Reference Laboratory (NRL) for food-borne parasites, excluding *Echinococcus* sp.: ANSES, Maisons-Alfort Laboratory for Animal Health

(7) Regulation (EC) No 854/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:226:0083:0127:FR:PDF>).

(8) Order of 18 December 2009 on the health rules applicable to animal products and foods containing them (<http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000021533994>).