Measles in game and livestock

This article was requested by CANAM in an effort to highlight the increased risk of measles in both wildlife and cattle as a consequence of an increased number of people in the bush (e.g., charcoal production). A lack of proper field facilities forces people to defaecate in the bush. If these people are infested with tape worm, they will contaminate the field. This may result game and livestock to become infected and, on meat inspection, have "measles" in their muscles. In this article we explain what measles are, how they are transmitted and what you can do to prevent it.

It is important to note that the measles described in this article refers to tapeworm cysts in the meat, scientifically called cysticercosis. Measles affecting human (a virus called rubella) causes a distinctive red rash. From now on the word measles specifically refers to parasite cysts found in the muscle of animals.

What are measles?

Measles are caused by several different types of tapeworm. Specific tapeworm identification relies on microscopic examination as well as advanced DNA analysis. Affected meat typically shows a few to thousands white-ish, (usually) pea-sized nodules. The economic consequences of measle-infected meat can be limited (cutting away infected sections and downgrading the meat) to severe (entire carcass can be condemned). Irrespective of the tapeworm species involved, as well as the species being affected, the transmission and mechanism of disease is quite similar. The most important tapeworms are:

Beef tapeworm

Measles in cattle is often caused by the human tapeworm *Taenia saginata*. Cattle can become infected when they ingest forage or water which is contaminated by infected human faeces, or by improperly treated human waste water used for irrigation. When cattle ingest the tapeworm eggs or segments, the eggs will hatch inside the intestinal tract. From there, embryos of the tapeworm are released into the blood stream where they go all over the body, and settle in the muscles.

Meat measles are characterized by small white nodules. © University of Pretoria

After +/- 16-18 weeks the immature form of the tapeworm becomes a cyst (the tapeworm encysts). These cysts can survive up to 30 months, after which they usually calcify. Infected cattle usually don't show any symptoms. The diagnosis is made at slaughter when the white and/or fluid-filled little cysts are detected in the meat. The cysts are usually found in "the most hard-working" muscles such as the heart, masticatory muscles (jaw), tongue, muscles between the ribs and diaphragm, but can be found in any striated muscles (muscles that have a striped appearance).

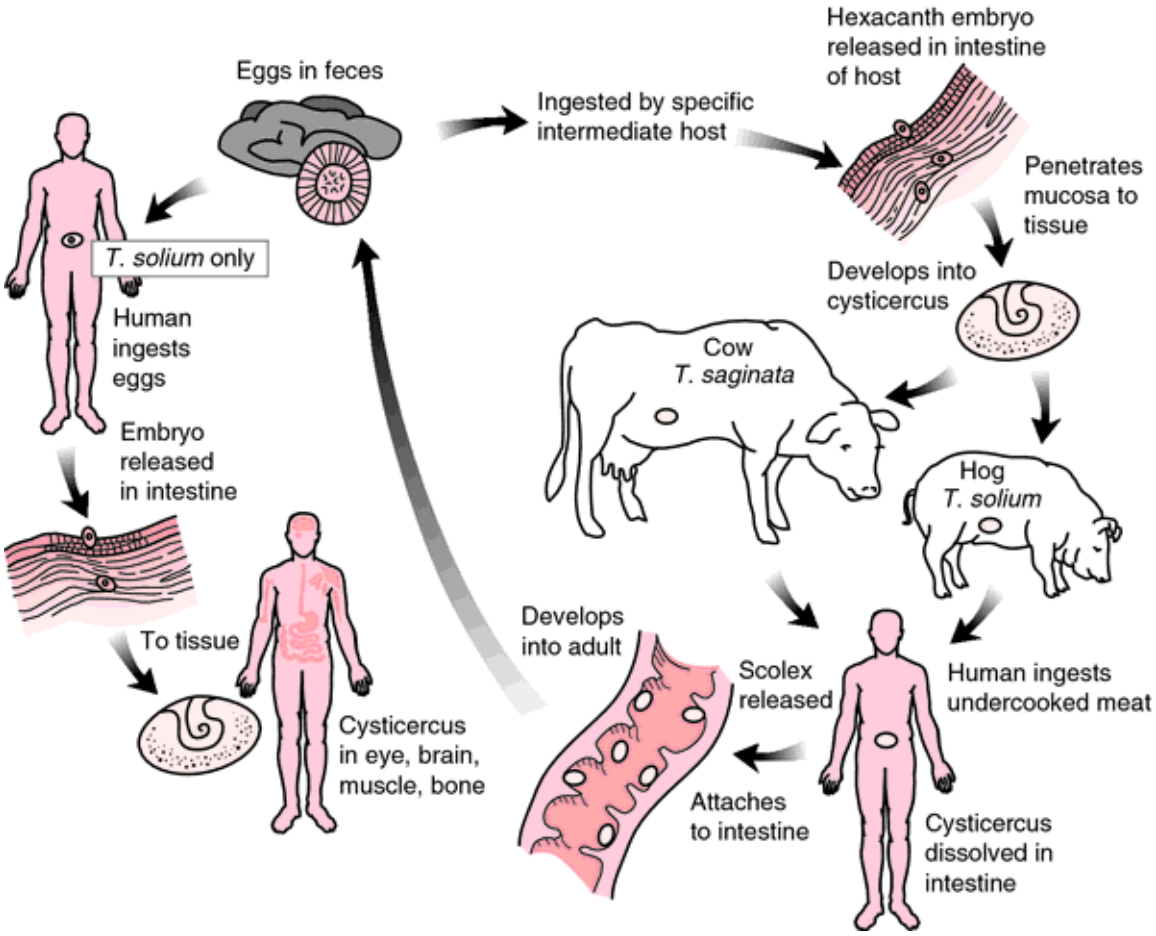
Cattle are the intermediate host and humans are the definite host of this parasite. As a result, the parasite can only complete its lifecycle when humans eat contaminated undercooked meat. At that stage the tapeworm will hook onto the small intestine and live a long and happy life, shedding segments containing eggs into the hosts (humans) faeces. Once outside, segments can crawl quite a distance before disposing their eggs.

A tapeworm can live inside humans for years, without causing any symptoms. Sometimes people get mild symptoms, such as nausea or abdominal pain and itchiness around the anus.

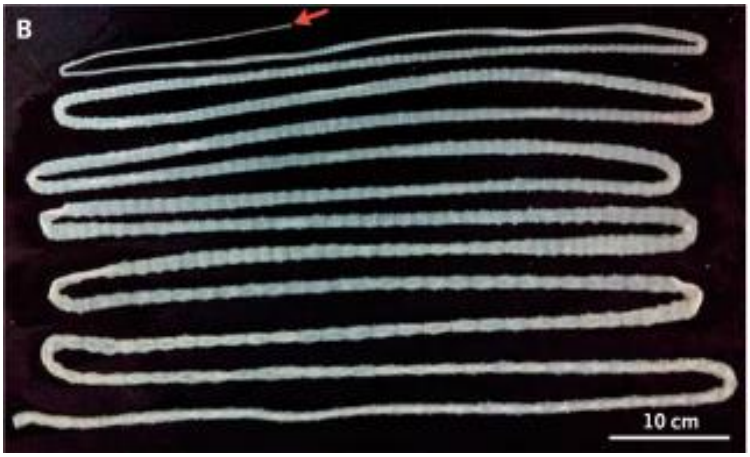
Dr. Ulf Tubbesing
P.O. Box 50533 Bachbrecht, Windhoek
+264 (0) 81 128 0350 ulf@wildlifevetsnamibia.com
www.wildlifevetsnamibia.com

Pork tapeworm

Measles in pigs and swine are caused by the tapeworm *Taenia solium*. Again, humans are the definitive host and when infected, excrete eggs and segments in the faeces. When a swine ingests these, cysts will develop in the muscles. Unlike the beef tapeworm, this tapeworm can cause serious problems in humans when it is dislodged from the small intestines, and enters the stomach and/or brain. The parasite can then cause neurological symptoms and seizures.



This image shows the schematic life cycles of the Taenia tapeworm species. In short, infected faeces from humans is ingested by cattle or swine, and the tapeworm creates cysts in the muscles. When humans consume contaminated undercooked meat, they can become infected. The tapeworm latches onto the small intestine, where it can live for years. Segments and eggs are excreted in the human faeces, which can be ingested again by cattle or swine. © *Mahon and Manuselis, 2000.*



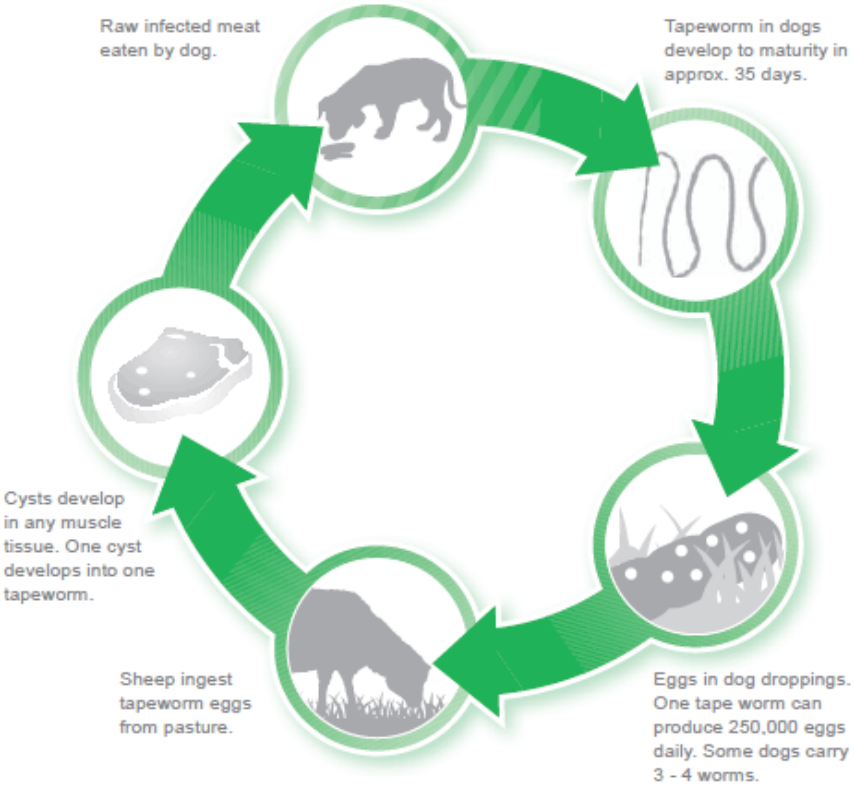
This beef tapeworm had been living for approx. 2 years in the small intestine of a man in China, who enjoyed eating raw beef. The tapeworm was over 6 meters in length! © *The New England Journal of Medicine*

Dr. Ulf Tubbesing
P.O. Box 50533 Bachbrecht, Windhoek
+264 (0) 81 128 0350 ulf@wildlifevetsnamibia.com
www.wildlifevetsnamibia.com

Sheep and goats

Sheep measles, called *Taenia ovis*, are spread by dogs and dog-like species such as jackals. The dog is the definitive host; the tapeworm lives inside the intestines of the dog, from where it is excreted by the faeces. The dog itself usually does not show symptoms. Sheep and goats are the intermediate hosts, once they take in contaminated material, the immature tapeworm travels through the body and enters the muscles, just like the beef and pork measles. These measles do not affect humans but it will downgrade the meat.

Another measle-type in goats, sheep, game and sometimes young cattle is caused by the *Taenia multiceps*. It spreads the same way as *Taenia ovis*, and dogs and jackals are the definitive host. This tapeworm however can cause big problems, as it sometimes causes cysts in the brain, causing 'turning sickness' ('malkopsiekte' or 'draaisiekte' in Afrikaans). Affected animals will keep on turning, keeping their head skew, pressing their head against something, and sometimes it seems as if they are blind. Note that humans are also susceptible to developing these complications!



Schematic overview of how sheep measles (Taenia ovis) are transmitted. © *VetCare Kaikoura*

Dr. Ulf Tubbesing
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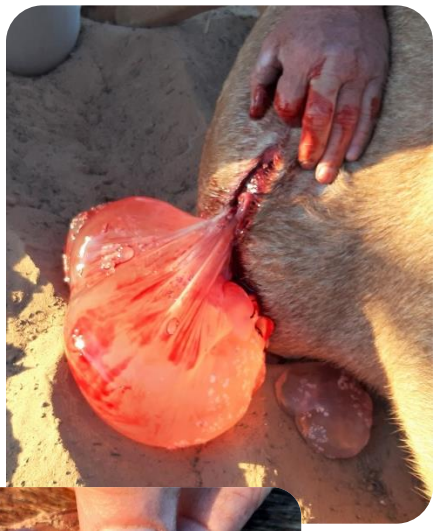
+264 (0) 81 128 0350 ulf@wildlifevetsnamibia.com
www.wildlifevetsnamibia.com

Cystic echinococcosis

Another tapeworm which can cause big problems is the *Echinococcus granulosus*. This tapeworm causes fluid-filled cysts in the body, called cystic echinococcosis. It can affect any mammal, including humans.

The definite host are predators, such as dogs or lions, who are rarely affected by the infection. In the intermediate hosts (e.g. sheep or roan) the cyst grows very slow, and the animal won't show any signs until the cysts start damaging adjacent tissues and organs. A lump might be observed, but it may also only be noticed upon slaughtering the animal. The cyst can occur in any organ of the body, from the liver, the lungs, muscles, brain or chewing muscles. The cyst can also lie free in the abdominal area.

Humans also can become infected by ingesting the parasite's eggs in contaminated food, water, or via contact with faeces. Human infection with *E. granulosus* (also called hydatidosis) can lead to the development of cysts, usually in the lungs and liver, and sometimes in the bones, kidneys, spleen, muscles and central nervous system. It can take several years for the cysts to become big enough that they start causing signs. When it occurs in the liver, it can cause abdominal pain, nausea and vomiting. When the lungs are affected, it can lead to chronic cough, chest pain and shortness of breath. It is a complex infection to treat, which might even require extensive surgery.



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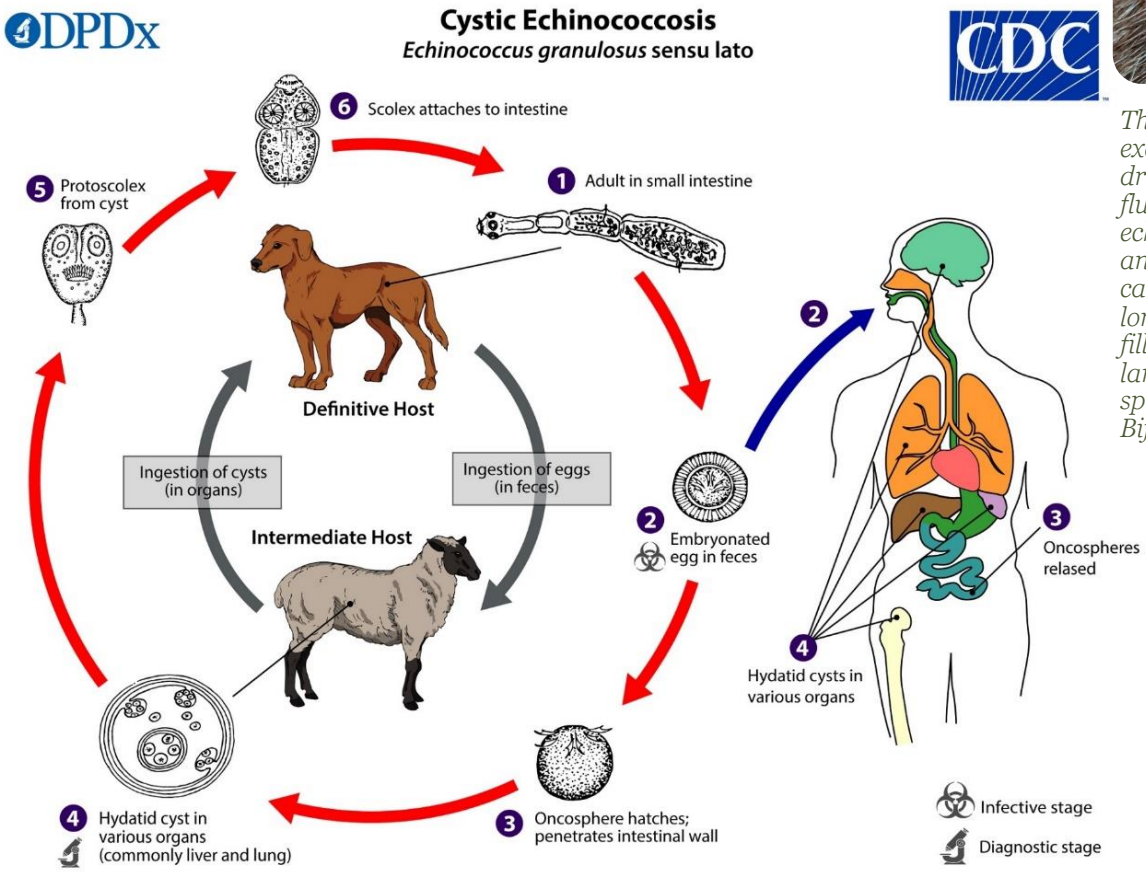
This roan had a lump on her hip. It was examined by inserting a needle and drawing up clear fluid. Due to the clear fluid, the suspicion was strong for cystic echinococcosis. A surgery was performed and one big cyst and one smaller cyst came out. The white little dots (2-7 mm long) are the larvae, which live in a fluid-filled cyst. If the cyst would break, all the larvae will disperse throughout the body, spreading the infection. © M. Bijsterbosch



Life cycle of the Echinococcus granulosus. The adult E. granulosus (2-7 mm long) lives in the small intestine of a definitive host (e.g. dog) (1). Eggs are released, and passed on into the faeces (2). They are immediately infectious. When a host (e.g. sheep) ingest these eggs, they hatch in the small intestines, and larvae (oncospheres) (3), penetrate through the intestines and migrate via the blood stream to various organs (especially the liver and lungs). The larvae develop into a cyst, which gets bigger and starts producing parasite larvae (protoscolices) and daughter cysts. The definitive host (e.g., dog), becomes infected by eating the cyst-containing organs. After ingestion, the parasite larvae (protoscolices) attach to the intestines (5-6), and develop into the adult stage in 32-80 days (1).

Humans are intermediate hosts, and can become infested by ingesting the eggs (2). The larvae (oncospheres) are released in the intestine (3), and cysts develop in several organs (4), If the cyst ruptures, it may cause secondary cysts in other sites of the body. © CDC

Treatment and consequences

Remember, an animal (or human) can be infected in two ways:

1) The actual tape worm in the gut. This rarely causes obvious symptoms other that the excretion of tapeworm segments, usually seen as white "rice grain or bigger" moving things in the stool or around the anus of the infected animal. Treatment at this stage is relatively easy – dose the animal with a good tapeworm remedy (get advice from your vet, SWAVET, AGRA etc.).
2) The cysts in the body usually do not cause obvious symptoms in infected animals. The diagnosis is made when the animal is slaughtered, and usually results in downgrading of the meat or, in severe cases a carcass being condemned. It is always best to be on the safe side and not to use infested meat for human consumption. Remember, some cysts may be caused by a tapeworm species that might cause serious problems in humans. In mildly infested carcasses, cut away the affected meat (frequently low value cuts) and discard these by burning. NEVER feed this to your dogs or leave in the field for jackal etc. to eat!

As stated before, both the diagnosis and treatment of animals symptomatic with a cystic disease is challenging! Animals showing signs of turning sickness can be treated with high doses of Praziquantel, however this is not always effective. When superficial cysts are diagnosed (bulging under skin or through muscle), one can surgically remove them. Once again, DON'T discard the removed cyst in the field!

Tapeworm species	Definitive host Excreted in faeces	Intermediate host	Causes	Dangerous for humans?
Beef tapeworm (*Taenia saginata*)	Humans	Cattle	Cysts in the meat	No
Pork tapeworm (*Taenia solium*)	Humans	Pigs and swine	Cysts in the meat	Rarely, abnormal cyst migration can cause neurological symptoms and seizures
Sheep measles (*Taenia ovis*)	Dog-species	Sheep and goats	Cysts in the meat	No
Sheep measles (*Taenia multiceps*)	Dog-species	Sheep and goats	Cysts in the meat, turning sickness	Yes! Can cause cysts in the brain
Echinococcus granulosus	Dog- and carnivore species	Herbivores	Small to big cysts in the meat, brain	Yes! Can cause cysts all over the body

Prevention

Since measle infested carcasses are at the least downgraded and at worst rejected out of hand, this can have a significant negative economic impact on a farmer's income. As a result, prevention is better than cure! There are a few things you can do to avoid contamination on your farm:

- Avoid faecal contamination by providing farm workers and their families with a toilet or long drop, and strictly enforce their use.
- Educate farm workers and their families about proper hygiene, and possible contamination of meat via faeces. Always wash hands when working with meat, and after going to the toilet!
- Consider regular deworming of all the farmworkers as well as their families (including you and your families) with a good quality dewormer effective against tape worm. Make sure that the drug used also kills tape worm!

Dr. Ulf Tubbesing
P.O. Box 50533 Bachbrecht, Windhoek
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www.wildlifevetsnamibia.com

- Train your workers how to identify measles and always do a proper meat inspection! If you or your workers find white spots when processing the meat, do not cut them open! Cut away the affected meat and discard (e.g., burn) it. Don't feed the affected meat to your dogs.
- If you treat or handle possible affected animals, make sure you wash your hands well afterwards, or wear gloves (discard properly after usage).
- Be careful with eating raw or undercooked meat when this originates from a farm practising questionable meat hygiene.
- Deworm your livestock as recommended by your veterinarian.
- Deworm your dogs every 3-6 months with an effective dewormer (don't buy the cheapest you can get in the shop, they are rarely effective and thus a waste of money), especially when they walk around kraals and can come into contact with sheep and goats.
- Do not let dogs or jackals walk around your slaughter house/meat room.
- When you feed sheep/goat meat to your dogs, preferably freeze the meat for at least 10 days, or cook the meat.

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