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Review Article

A Review of the Importance of Trichinosis in Public Health and the Status of Infection with This Parasite in Ethiopia

Getahun Berhanu Mulisa[1*], Tesfaye Rebuma Abdeta[1], Ammar Ahmed Abdelmola[2]

[1]School of Veterinary Medicine, Ambo University Guder Mamo Mezemir Campus Veterinary Teaching Clinic, Ambo, Ethiopia
[2]Department of Medical Laboratory Technology, College of Applied Medical Sciences, Jazan University, Jazan 45142, Saudi Arabia

Abstract
Trichinella is one of the most important zoonotic parasitic nematodes with worldwide prevalence. *Trichinella* larvae are usually found inside the muscle tissue of the animals such as pigs and mice. This parasite enters into human's small intestine following the consumption of infected pork and, then, excretes the male worms through his/her feces. Eight different species of this parasite have so far been identified including *Trichinella spiralis, Trichinella nativa, Trichinella nelsoni, Trichinella britovi, Trichinella murrelli, Trichinella pseudospiralis, Trichinella papuae, and Trichinella zimbabwensis.* Other remaining worms are transferred to other parts of the body by the blood, and from there they migrate, especially, through the muscles of the abdominal wall, tongue, and larynx, thereby causing swelling and calcareous cysts inside the muscles. Other mammals such as cats, dogs, foxes, pigs, and boars also usually get this disease after eating the meat of mice or other infected animals.Humans can also develop this disease by consuming pork or boar meat. The spread of this disease is rare in Islamic countries where pork is not consumed due to the religious observance, but its spread is rapid in countries from Europe and South America where the disease afflicts 12% of their human population mainly due to a failure to cook or freeze the meat perfectly.
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Introduction

Trichinella spiralis is a viviparous nematode parasite with global prevalence. Human infection with parasite larvae was first reported in 1828. Then in 1835, Paget found the larval stage of the worm in the muscles of a patient died of tuberculosis, and called it Spiralis due to the shape of the larva which was entwined in the muscle (1). In 1860, the role of this parasite in causing Trichin's disease was confirmed. Human contamination is currently seen in European and American countries where eating pork is common. The contamination is especially prevalent in Germany, Poland, Spain, Hungary, and southern European countries. This widespread disease is still considered one of the major health problems in North America and Latin American countries where it sometimes spreads in the form of small epidemics (2).

Trichinella is one of the most important zoonotic parasitic nematodes worldwide (3,4). Eight different species of this parasite have so far been identified, which include *Trichinella spiralis, Trichinella nativa, Trichinella nelsoni, Trichinella britovi, Trichinella murrelli, Trichinella pseudospiralis, Trichinella papuae, and Trichinella zimbabwensis.*

The adult Trichin worm is a nematode, extremely thin, and thread-shaped worm. The male worm is 1.4-1.6 mm long and 40-50 microns in diameter, while the female worm is 3-4 mm long and 60 microns in diameter (5).

Literature Review on Trichinosis

Symptoms of Trichinosis Infection

Symptoms of Trichin worm infection include: fever, nausea, vomiting, severe sweating, abdominal pain, simple diarrhea, dysentery, heart palpitations, painful swallowing, lethargy, severe weight loss, severe swelling of hands and feet, and low blood pressure (6,7). Its other complications include fever, nausea, diarrhea, colic, lung complications, heart, brain, eye complications, and even death (8). According to the evidence, the death rate of this disease may even reach 5% among the infected patients.

Clinical Diagnosis of Trichinosis

If there is a large number of the worms, then the following symptoms may appear:

1. Irregular fever lasting one to two weeks and reaching 40 to 41 degrees.
2. Presence of swelling around the eyes in two weeks

*Corresponding Author: Getahun Berhanu Mulisa, Email: getahunberhanu21@gmail.com

of illness.
3. Severe intestinal discomfort in the first 24 hours, sometimes lasting up to a week.
4. Referral of the patients in a group and their history of eating semi-cooked pork.
5. Hyperosinophilia and bleeding under the nails of the fingers and toes.
6. Severe muscle pain starting from the second week of the infection.

Laboratory Diagnosis of Trichinosis

To this end, the following methods are used:
1. The larvae are located in the muscles after performing a biopsy of the muscle. Then the tissue is placed between the two slides and the larvae are observed under the microscope after crushing the muscles by applying pressure or by dissolving them in a liquid containing pepsin and hydrochloric acid.
2. Stool test is performed adopting the concentration method and observing the adult worm and its larvae. This method rarely produces a positive result.
3. The serological methods are employed by performing the following (a) Bachmann intradermal reaction and (b) Precipitin test.

Treatment of Trichinosis

There is no specific treatment for the disease. Some practitioners recommend the prescription of saline laxatives during the intestinal catarrh period, because it facilitates removing a number of the adult female worms before they hatch, thereby reducing the severity of the disease (9-11).

Prescription of anthelmintic drugs (e.g., thiabendazole) and combination of piperazine and hetrazan during the disease's development period has been also found to produce therapeutic outcomes (12,13). It is sometimes recommended that the anti-allergic drugs should be used to benefit from a symptomatic treatment (14).

Epidemiology of Trichinosis

Trichin infection is usually observed among the enzootic animals. Black rats often transmit the disease to each other by eating other rats' carcasses (15,16). Most mammals (e.g., cats, dogs, foxes, pigs, and boars) are vulnerable to the parasite (17-19) and get infected by eating raw meat or other infected animals (20). Human infection is usually caused by eating pork meat, but it may also be caused by having bear or wild boar meat (21).

The ratio of human to parasite contamination varies in different places. Human contamination is extremely rare in Islamic countries where pork is rarely consumed due to religious observance; in other countries, however, the human contamination proportion is relatively high (e.g., the contamination ratio is 12% in South America [Mexico and Chile] and 11% in Europe). The contamination ratio also varies in different parts of a country (22).

There might be a high count of worms in the human intestine and, as a result, a high count of larvae in his/her muscles, which may reach up to one thousand larvae per gram of muscle in some cases (23). The contamination ratio is higher in winter due to the consumption of more meat in this season. The contamination rate in parasite reservoirs (e.g., pigs) is usually lower and around 1.5%. This ratio varies based on the feeding methods of pigs, so that it is between 5.3 to 11% in areas where the pigs are fed with garbage and waste. Table 1 summarizes the

Table 1. Different Aspects of the Trichinosis Epidemiology

Species or Genotype	Geographical Distribution	Host Range	Main Source of Infection in Human
		Encapsulated	
T. spiralis	Cosmopolitan	Domestic and sylvatic mammals	Domestic and sylvatic swine horse
T. nativa	Arctic and subarctic areas of America, Asia, Europe	Sylvatic carnivores	Bears, walruses
Trichinella genotype T6	Canada, Alaska, Rocky Mountains, and Appalachian Mountains in the United States	Sylvatic carnivores	Carnivores
T. britovi	Temperate areas of Europe and Asia, northern and western Africa	Sylvatic mammals and rarely domestic pigs	Wild boar, domestic pig, horse, foxes, jackal
Trichinella T8	South Africa and Namibia	Sylvatic carnivores	None documented
T. murrelli	United states and southern Canada	Sylvatic carnivores	Bears, horses
Trichinella genotype T9	Japan	Sylvatic carnivores	None documented
T. nelson	Eastern-southern Africa	Sylvatic mammals	Warthogs, bush pigs
Trichinella genotype T12	Argentina	Cougars	None documented
		Non-encapsulated	
T. pseudo spiralis	Cosmopolitan	Sylvatic mammals and birds, domestic pig	Domestic and wild pigs
T. papuae	Papua new guinea, Thailand	Wild pig, salt water crocodile	Wild pig
T. zimbabwensis	Zimbabwe, Mozambique, south Africa, Ethiopia	Nile crocodiles, monitor lizards	None documented

Source: (9).

epidemiology of trichinosis.

Status of Trichinosis in Ethiopia

At least two confirmed outbreaks of Trichinosis were reported in Ethiopia (from the Gojjam administrative region and Central Arsi). The outbreak was associated with the ingestion of meat from a wild boar. In this outbreak and out of 30 soldiers, 20 ones having raw meat became ill and five ones were admitted to the hospital with distinctive histories and clinical features of the disease. The diagnosis was confirmed by a deltoid muscle biopsy in all five cases (15,24).

Conclusion and Recommendation

Consuming raw or undercooked meat containing *Trichinella* larvae can result in the parasitic zoonosis disease Trichinosis. This illness poses a risk to public health and creates an economic burden for producers of the pig meat. Epidemiologically, it has a sylvatic and domestic cycle of transmission. In this study, *Trichinella* larvae were detected adopting a number of standard Sero diagnostic techniques in addition to the direct method. Muscle biopsy, ELISA, and PCR methods were important tools for the diagnosing the infection. It was found that this disease may have been controlled and prevented, and it has a therapy.

Taking into account the aforementioned conclusion, it was recommended that:

- The consumers should be educated about the risks of consuming raw/undercooked meat or other pork products from both domestic and wild pigs.
- A rigorous quarantine should be implemented to regulate the killing and distribution of meat from possibly contaminated animals.

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Authors' Contribution

Conceptualization: Getahun Berhanu Mulisa, Tesfaye Rebuma Abdeta, and Ammar Ahmed Abdelmola.
Data curation: Tesfaye Rebuma Abdeta and Ammar Ahmed Abdelmola.
Formal analysis: Tesfaye Rebuma Abdeta.
Funding acquisition: Ammar Ahmed Abdelmola.
Investigation: Getahun Berhanu Mulisa.
Methodology: Tesfaye Rebuma Abdeta and Ammar Ahmed Abdelmola.
Project administration: Ammar Ahmed Abdelmola.
Resources: Tesfaye Rebuma Abdeta.
Software: Tesfaye Rebuma Abdeta, Ammar Ahmed Abdelmola, and Ammar Ahmed Abdelmola
Supervision: Getahun Berhanu Mulisa.
Validation: Tesfaye Rebuma Abdeta.
Visualization: Tesfaye Rebuma Abdeta and Ammar Ahmed Abdelmola.
Writing–original draft: Getahun Berhanu Mulisa.
Writing–review & editing: Getahun Berhanu Mulisa.

Competing Interests

The authors declare that they have no conflict of interests.

Ethical Approval

Not applicable.

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