

## The Ethiopian SORT IT Course

# Cysts and parasites in an abattoir in Northwest Ethiopia; an urgent call for action on “one health”

Desalegn Getahun<sup>1</sup>, Saskia van Henten<sup>2</sup>, Aduigna Abera<sup>1</sup>, Mbazi Senkoro<sup>3</sup>, Philip Owiti<sup>4</sup>, Fantu Lombamo<sup>5</sup>, Blen Girma<sup>1</sup>, Baye Ashenefe<sup>6</sup>, Asefa Deressa<sup>1</sup>, Ermias Diro<sup>7</sup>

<sup>1</sup> Ethiopian Public Health Institute, Addis Ababa, Ethiopia

<sup>2</sup> Institute of Tropical Medicine, Antwerp, Belgium

<sup>3</sup> National Institute for Medical Research, Muhimbili Centre, Dar es Salaam, Tanzania

<sup>4</sup> The Union, Paris, France

<sup>5</sup> Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

<sup>6</sup> Gondar Elfora Abattoir, Gondar, Ethiopia

<sup>7</sup> Department of Internal Medicine, University of Gondar, Gondar, Ethiopia

### Abstract

**Introduction:** Zoonotic parasitic infections such as echinococcosis affect cattle, sheep and goats by lowering quality of meat and hides as well as decreasing milk production. The burden of such diseases among humans is usually underestimated as they are difficult to diagnose. We used abattoir data to estimate the prevalence of zoonotic parasitic infections in animals.

**Methodology:** Data from 2005-2018 was used from the registry of an abattoir in Northwest Ethiopia. Frequencies, proportions and trends over time were analyzed. Meat inspection was conducted by visualization, palpation and incision.

**Results:** A total of 58,787 animals were slaughtered in the abattoir during the study period. These included 51,956 (88 %) cattle, 5,890 (10%) sheep and 941 (2%) goats. The detected parasites included *Echinococcus* in 12,334/58,787 (21%) and *Fasciola* in 10,551/58,787 (18%) animals. *Echinococcus* infection was highest among goats (267/941, 28%), followed by cattle (11,591/51,956, 22%) and sheep (476/5,890, 8%). Fasciolosis was detected in 9,877/51,956 (19%) cattle and 178/941 (19%) goats. The number of animals slaughtered strongly decreased over time from 8,405 in 2006 to 1,605 in 2018. However, the proportion of parasitic infections remained high with some fluctuations over the study period.

**Conclusions:** Echinococcosis and fasciolosis were very common with one out of five animals slaughtered infected. This is of public health concern and needs urgent multi-sectorial efforts from stakeholders at the national and regional level for control of these diseases. One health program approaches may warrant the control of transmission to humans.

**Key words:** hydatid cyst; veterinary medicine; operational research; abattoir survey; livestock.

*J Infect Dev Ctries* 2020; 14(6.1):53S-57S. doi:10.3855/jidc.11713

(Received 29 May 2019 – Accepted 03 October 2020)

Copyright © 2020 Getahun *et al.* This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### Introduction

Zoonotic parasitic infections are an important public health problem which require a one health approach strategy for control [1-4]. Transmission to humans occurs by ingesting parasites in contaminated food, water or soil and through direct contact with dogs, cattle or other domestic animals. In Ethiopia, the common practice of backyard slaughtering, high numbers of free-roaming dogs, lack of abattoirs proportional with the population and improper waste disposal of infected organs may all contribute to high levels of transmission [3]. Studies showed offal is easily accessible to scavenging dogs, cats and other wild carnivores [5].

Zoonotic parasites can cause huge economic losses through decreased productivity of animals affected, and through condemnation of infected organs such as livers, kidneys and meat. They may also decrease milk production, animal fertility and hide quality [6]. Diagnosis of zoonotic parasites in animals is usually done by post-mortem visual inspection, incision and palpation of the organs. This is systematically done for all animals slaughtered in abattoirs [3]. Commonly detected parasites include *Echinococcus*, *Fasciola*, and *Taenia*, of which *Echinococcus* is one of the nationally prioritized zoonotic diseases in disease control programs [7,8].

Based on abattoir reports, the prevalence of echinococcosis in animals in hyperendemic areas

ranges from 20%-95% [3]. In Ethiopia, there are small abattoir-based studies on a limited number of cattle, sheep and goats that show a prevalence range of echinococcosis from 6% in Central Oromia, Adama [9] to 53% in Hawasa [10]. Prevalence in North Gondar Zone was 21% [11].

In humans, infections with zoonotic parasites are characterized by an indolent manifestation, making them hard to diagnose even though they may be deadly. For example, diagnosis of *Echinococcus* in humans is often accidental, based on ultrasound examinations done for other clinical indications[3]. Therefore, prevalence data are likely a gross underestimation of the real burden of disease in humans. Abattoir-based animal studies may give indications about the risk of transmission to humans. The trend in prevalence can help determine whether the risk of transmission is increasing.

In this study we investigated the trend and prevalence of echinococcosis and other zoonotic parasitic diseases among animals in an abattoir in North Gondar zone in Ethiopia during the period 2005 to 2018.

**Methodology**

*Study design*

A cross-sectional study using retrospective abattoir data from September 2005 to September 2018 was conducted.

*General setting*

Ethiopia is in the horn of Africa and has the second largest human population with the biggest livestock population on the continent. About 80% of Ethiopians have a mixed agricultural practice (both growing crops and raising livestock), while they also often have dogs to protect their farms. According to the Ethiopian Federal Ministry of Agriculture data, there are a total of

293 abattoirs in Ethiopia, with most slaughtered animals originating from the surrounding rural areas.

In recent years, a national program dedicated to one health has been established, prioritizing five zoonotic diseases. However, this program is not supported by the government and other organisations, and no solid publications have come out so far.

*Specific setting*

ELFORA abattoir is found in Gondar city, North Gondar zone which is located 727 km Northwest of Addis Ababa in Amhara Regional State. Studies showed that North Gondar is one of the endemic areas of echinococcosis with a prevalence of 21% [11]. The area has an altitude of 550 to 4,620 meters above sea level. The district comprises a livestock population of 1,936,514 cattle, 524,083 sheep and 682,264 goats [12]. The abattoir was established 40 years ago. It is the only abattoir in the North Gondar zone, providing services for Gondar city and its catchment areas. Cattle, sheep and goats are the three species of animals slaughtered in the abattoir.

*Routine procedures*

Routine abattoir meat inspections are conducted by veterinarians or trained inspectors. All meat inspection team members, including the butchers, take food safety, hygiene and food handling training regularly.

In slaughtered animals, the presence of any abnormalities as well as diseases like *Echinococcus* and other zoonotic parasites such as *Fasciola*, lungworm, and *Taenia* are checked. The examination includes the visceral organs (liver, lung, heart, spleen and kidney), carcasses, lymph nodes, heads, and tongues and is conducted by visualization, palpation and incision of each slaughtered animal. Any organ abnormalities or defects that are unsafe for human consumption will either be treated by chilling, condemned or buried. All parts of the animal should be kept together and

**Table 1.** Operational definitions.

No	Operational terms	Operational definitions
1.	<i>Echinococcus</i> (Hydatid cyst)	Presence of cysts commonly measure 5 – 10 cm and contain fluid. Some may reach up to 50 cm in diameter. They can be found in the lung, liver, kidney, heart, muscles, brain and even bones
2.	Cysticercosis ( <i>Taenia</i> )	Presence of small white lesions in muscle tissue which appear as clear transparent bladders 5 × 10 mm with an opaque and pearl appearance
3.	<i>Fasciola</i> (Liver fluke)	Presence of leaf shaped parasites (flukes) measuring 2.5 cm to 5 cm by 1.3 cm. in enlarged and thickened bile ducts and in the liver parenchyma, as well as calcification of bile ducts and blackened lymph nodes of the lungs and liver due to fluke excrement
4.	Lungworm	Presence of hemorrhagic inflammation of bronchi with froth, lung edema and emphysema, consolidation of lung parenchyma, lung worms, or enlarged lung lymph nodes
5.	Signs of parasitic infection (Calcification and Cirrhosis)	Presence of white or grey tissue, irregularly rounded and frequently honeycombed, or a gritty sound upon incision of the tissue with a knife

correlated for inspection before they are removed from the abattoir floor. All findings are routinely registered within the case registry [7] (Table 1).

*Study animals*

All cattle (bovine), sheep (ovine) and goats (caprine) slaughtered and registered at the abattoir during the study period were included.

*Data collection and analysis*

The routine meat inspection abattoir case registry was used as a source of data. Variables collected were the type of animal, sex, year, the presence and type of parasitic infections and other signs of parasitic infection. Data were double entered directly into Microsoft Excel version 10. Annual numbers of slaughtered animals and the number of animals with echinococcosis and other zoonotic parasitic infection were computed to show the occurrence, proportion and trend over the last 14 years. Stata version 15 was used to show the trend over time graphically among three species of slaughtered animals.

*Ethical approval*

Permission to conduct the study was obtained from Gondar ELFORA abattoir, Gondar, Ethiopia. Institutional ethics approval was received from the Ethiopian Public Health Institute (EPHI) in Addis Ababa, Ethiopia. The study was also approved by the Ethics Advisory Group of the International Union against Tuberculosis and Lung Disease, Paris, France.

**Results**

A total of 58,787 animals were slaughtered in the abattoir from 2005-2018. Of these, 52,935 (90%) were male. Three species of animals were slaughtered in the abattoir; 51,956 (88%) cattle, 5,890 (10%) sheep and 941 (2%) goats. Data on goats was available only for four years (2005-2009). There was a decreasing pattern in the total number of animals slaughtered at the abattoir over the study period (Figure 1 and 2). However, the proportion affected by parasites remained persistently high (Figure 2 and 3).

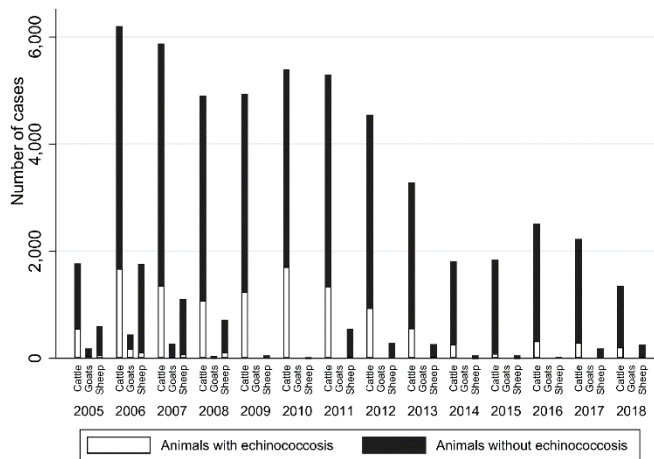
The overall prevalence of echinococcosis among all slaughtered animals during the last 14 years was 12,334/58,787 (21%). Echinococcosis was found in 267/941 (28%) goats, 11,591/51,956 (22%) cattle and 476/5,890 (8%) sheep. The highest prevalence was observed in goats in 2006 when it was 41% and the lowest among sheep with 4% in 2015. Echinococcosis prevalence was persistently high from 2005 to 2013, but a decrease in prevalence was observed in 2014 and 2015

(14% and 5%). However, the prevalence rose again from 5% in 2015 to 15% in 2018 (Figure 3).

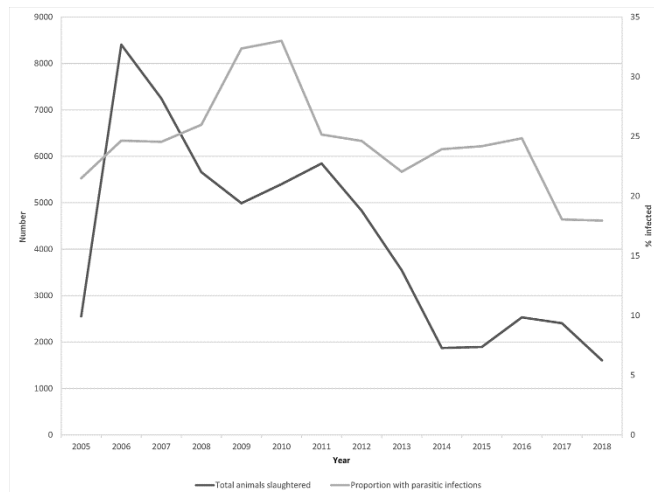
Fasciolosis was detected in 10,551/58,787 (18%) of all slaughtered animals with 9,877/51,956 (19%) cattle, 178/941 (19%) goats and 496/5,890 (8%) sheep having the infection. The infection rate ranged from 14% to 23% in the years 2005 to 2015, after which it showed a progressive decline to 4% in 2018 (Figure 3).

Infection with other zoonotic parasites such as lungworm, *Taenia* and *Tenicullos* was uncommon. However, liver cirrhosis and calcifications in different tissues were commonly found and were increasing in the last four years (Figure 3).

**Figure 1.** Bar graph showing the number of *Echinococcus* infected and uninfected animals at an abattoir in Northwest Ethiopia, 2005-2018.



**Figure 2.** Trends in the prevalence of zoonotic parasite infections among slaughtered cattle, sheep and goats in Northwest Ethiopia from 2005-2018.



### Discussion

This is the first study reporting on zoonotic parasitic infections over a longer time frame in Ethiopia. The findings are alarming with one out of five slaughtered animals affected by echinococcosis or fasciolosis. Other evidence of parasitic infections such as liver cirrhosis and tissue calcifications were also common. Especially goats (28% and 34%) and cattle (22% and 38%) were highly affected by *Echinococcus* and *Fasciola*. Although a decline in prevalence was observed in 2014-2015, no clear reason for it could be identified. Furthermore, the decline was not sustained.

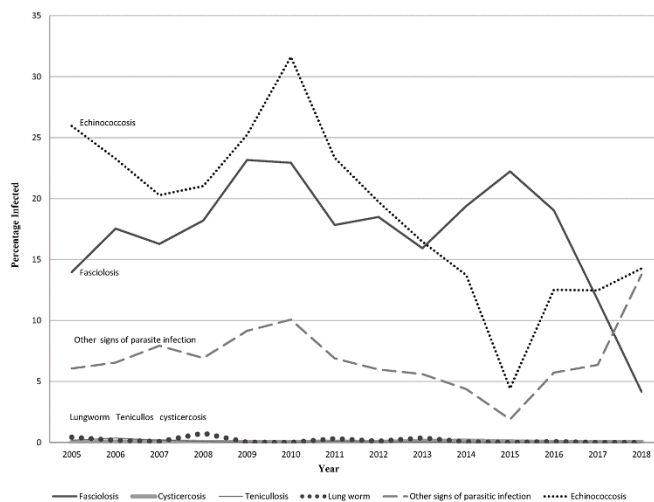
These findings are in line with findings from other smaller studies conducted in Ethiopia, which showed a prevalence of echinococcosis between 20-52% [11,13-15]. A study conducted among cattle in North Gondar zone show a fasciolosis infection rate of 23% [16].

The persistently high prevalence of zoonotic parasitic infection over a long period indicates high levels of transmission in this region. Reasons for this are likely to be related to the common practice of backyard slaughtering and gaps in proper disposal mechanisms. There are no regulations enforced on disposal of animal leftovers, especially outside of the abattoirs. The high prevalence of parasitic infections among animals has significant implications for the risk of transmission to humans, especially in Ethiopia, where the majority of the population lives near both cattle and dogs.

With increasing urbanization, an increasing number of hotels and restaurants, high expansion of universities and boarding schools, we expected an increase in meat consumption and number of animals slaughtered every year at the abattoir. However, our data surprisingly showed a declining trend in yearly slaughtered animals. This finding may indicate that consumers are conducting more backyard slaughtering rather than using the abattoir. A reason for this may be that the high rate of parasitic infections leads to increasing rejection rates of organs and meat at the abattoir and therefore, consumers might opt out from using the abattoir for fear of losing their product. Unhygienic slaughtering practices, improper disposal of infected organs and their subsequent consumption by dogs and cats are all likely to contribute to a vicious cycle of re-infection.

These findings call upon an urgent need for implementation of disease control against parasitic infections in the area. A strategic and sustainable one health approach program should be employed with multiple level interventions. We advise the following strategies: 1) all stakeholders need to be aware of the magnitude of the situation and integrate efforts for its

**Figure 3.** Graph showing the number of slaughtered animals and the proportion with parasitic infection in Northwest Ethiopia, 2005-2018.



control. 2) resources should be mobilized for a deworming campaign among cattle, sheep and goats as well as other domestic animals including dogs and cats. 3) use of slaughterhouses should be encouraged. Pastoralists should be compensated for their animals in case infected meat and organs are discarded. 4) backyard slaughtering should be discouraged, and waste disposal mechanisms should be improved. 5) raw infected organs should not be fed to dogs and cats to interrupt the transmission. 6) health education on the risk of raw meat and milk consumption needs to be strengthened.

Our study was subject to a few limitations. Data taken from the routine abattoir meat inspection registry was limited, and therefore transmission hotspots and risk factors of infection could not be determined. Adding variables such as the specific address and characteristics of each animal to the registry can help answer these questions. Since parasitic infections were diagnosed by visual inspection and palpation only, findings may be subject to the skill of the meat inspectors and parasites that require other diagnostics may have been missed.

### Conclusion

Zoonotic parasitic infections are very common in Northwest Ethiopia. High prevalence of echinococcosis, fasciolosis and other signs of parasitic infection persisted over a long period. These findings indicate a high risk of transmission to humans. A one health approach for disease control interventions should be employed urgently.



## Acknowledgements

This research was conducted through the Structured Operational Research and Training Initiative (SORT IT), a global partnership coordinated by TDR, the Special Programme for Research and Training in Tropical Diseases hosted at the World Health Organization. The training model is based on a course developed jointly by the International Union Against Tuberculosis and Lung Disease and Médecins Sans Frontières-Luxembourg (LuxOR). The specific SORT IT program that led to these publications included a joint implementing partnership between TDR, the Institute of Tropical Medicine Antwerp, Belgium, the University of Gondar, Ethiopia, the WHO country office in Ethiopia, Médecins Sans Frontières, Luxembourg (LuxOR) and the International Union Against Tuberculosis and Lung Disease, Paris France.

We would like to acknowledge Gondar ELFORA Abattoir authorities and staff and Ethiopian Public Health Institute (EPHI) for allowing us to use their data and budget.

## Funding

The program was funded by TDR, the Special Programme for Research and Training in Tropical Diseases and the Institute of Tropical Medicine Antwerp and supported by the various implementing partners. Ethiopian Public Health Institute (EPHI) provided funding for data collection.

## References

1. Woolhouse MEJ, Gowtage-Sequeria S (2005) Host range and emerging and re-emerging pathogens. *Emerg Infect Dis* 11: 1842-1847.
2. Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, Daszak P (2008) Global trends in emerging infectious diseases. *Nature* 451: 990-993.
3. Bulto GB (2015) Hydatidosis in ruminants and Echinococcosis in dogs: Epidemiology, histopathology and public health significance in Central Oromia, Ethiopia. Doctoral thesis of echinococcosis epidemiology research. University of Addis Ababa, CVMA. 1-40.
4. World Health Organization (2018) Echinococcosis fact sheet. Available: <http://www.who.int/news-room/fact-sheets/detail/echinococcosis>. Accessed 8 February 2019.
5. Eckert J, Deplazes P (2004) Biological, epidemiological and clinical aspects of echinococcosis, a zoonosis of increasing concern. *Clin Microbiol Rev* 1: 107-135.
6. Mitiku M, Amenu K (2017) Epidemiology of cystic bovine hydatidosis. Emphasis on abattoir findings in Ethiopia. *J Vet Med Res* 4: 1-5.
7. Food and Agriculture Organization (2000) Manual on meat inspection for developing countries Available: <http://www.fao.org/3/t0756e/T0756E00.htm>. Accessed 15 March 2019.
8. Pieracci EG, Hall AJ, Gharpure R, Haile A, Walegn E, Deressa A, Bahiru G, Kibebe M, Walke H, Belay E (2016) Prioritizing zoonotic diseases in Ethiopia using a one health approach. *One Health* 2: 131-135.
9. Getaw A, Beyene D, Ayana D, Megersa B, Abunna F (2010) Hydatidosis: Prevalence and its economic importance in ruminants slaughtered at Adama municipal abattoir, central Oromia, Ethiopia. *Acta Trop* 113: 221-225.
10. Regassa F, Mola A, Bekele J (2010) Study on the prevalence of cystic hydatidosis and its economic significance in cattle slaughtered at Hawassa Municipal abattoir, Ethiopia. *Trop Anim Health Prod* 42: 977-984.
11. Abebe A, Desat B, Kumsa B (2014) Cystic echinococcosis in cattle slaughtered at Gondar Elfora export Abattoir, northwest Ethiopia. *J. Parasit Dis* 38: 404-409.
12. Central Statistical Agency Federal Democratic Republic of Ethiopia (2018) Agricultural sample survey. Report on livestock and livestock characteristics. A statistical bulletin 587. Available: <http://www.csa.gov.et/ehioinfo-internal?download=723:livestock-and-livestock-characteristics-survey-report-for-the-year-2007-e-c-2014-2015&start=25> Accessed 07 May 2020
13. Fikire Z, Tolossa T, Nigusie Z, Macias C, Kebede N (2012) Prevalence and characterization of hydatidosis in animals slaughtered at Addis Ababa abattoir, Ethiopia. *J Parasitol Vector Biol* 4: 1-6.
14. Terefe D, Kebede K, Beyene D, Wondimu A (2012) Prevalence and financial loss estimation of hydatidosis of cattle slaughtered at Addis Ababa Abattoirs Enterprise. *J Vet Med Anim Health* 4: 42-47.
15. Belina T, Alemayehu A, Moje N, Yechale A, Girma S (2012) Prevalence and public health significance of ovine hydatidosis in Bahir Dar Town, Ethiopia. *J Vet Med Anim Health* 4: 110-115.
16. Gebrie M, Alemneh T (2015) Prevalence of bovine fasciolosis in and around Gondar, Northwestern Ethiopia. *Acta Parasitologica Globalis* 6: 231-237.

## Corresponding author

Desalegn Getahun, DVM, MPH-VPH, Researcher  
Ethiopian Public Health Institute, Addis Ababa, Ethiopia  
Telephone: +251-112-133499/751522  
P.O. Box: 1242/5654  
Tel: +251-913-112616  
Fax: +251-112-758634  
Email: [desupatch@gmail.com](mailto:desupatch@gmail.com)

**Conflict of interests:** No conflict of interests is declared.