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Prevalence of *Cysticercus Bovis* in Cattle Slaughtered at Kombolcha ELFORA Meat Processing factory, Northern Ethiopia

Meseret Kassaw¹, Wondimagegnehu Belay¹ and Wale Tesfaye¹¹School of Veterinary Medicine, Wolaita Sodo University, Wolaita Sodo, Ethiopia*Corresponding author: twalelgn@yahoo.com (Wale Tesfaye)

Abstract

Bovine cysticercosis infestation is an important zoonotic disease commonly frequent in African countries than in other parts of the world. A cross-sectional study was conducted on 425 randomly selected slaughtered cattle at Kombolcha ELFORA meat processing factory in Northern, Ethiopia from October 2015 to April 2016 to determine the prevalence of *Cysticercus bovis*, to assess some risk factor associated with it and to estimate the viability of *Cysticercus bovis* in different organs. The overall prevalence of cysticercosis was 4.7%. Infection prevalence of cysticercosis was no significantly associated with age, body condition and sex of cattle ($P > 0.05$). Infection rate of cysticercosis with respect to age group showed that higher prevalence was in adult (5%) than old cattle (4.4%) ($\chi^2=0.101$, $p =0.750$) and infection rate with respect to body condition revealed the highest prevalence (6.1%) was in poor followed by medium and good body condition scores 4.9% and 3.1%, respectively ($\chi^2= 1.357$, $p = 0.507$). Related to sex of cattle higher prevalence was in female (5.2%) than male animals (4.91%) ($\chi^2= 0.353$, $p = 0.552$). Heart (4.2%) was the most infected organ by large number of cysts followed by tongue (2.6%) and masseter muscle (2.6%), liver (1.2%) and diaphragm (0.9%) respectively. From a total of 49 cysts collected 27(6.3%) was viable where as the remaining 22(5.1%) was non-viable.

Keywords: Bovine; *Cysticercus bovis*; ELFORA, Kombolcha; Prevalence.

1. Introduction

Although the livestock sector in Ethiopia has a significant contribution to the national economy, productivity (meat and milk) per animal is very low (Shiferaw *et al.*, 2003). Animal wealth, especially cattle is one of great economic importance, which is considered the main source of meat, milk and hides in Ethiopia. Such meat is the most common animal protein for human consumption (Radwan, 2008).

One zoonotic disease livestock producers should be aware of is bovine cysticercosis. The disease is a concern because it usually indicates that human feces have contaminated the animal feed system (USDA, 2014). Bovine Cysticercosis is a food-borne parasitic

zoonosis caused by the larval stage of the tapeworm *Taenia saginata* commonly referred to as the beef tapeworm, locally known as “kosso” and is mainly related to the cherished and honored tradition of eating raw beef in most parts of the country (Jenberies, 2002). This larva is meat-borne and human infection results from the ingestion of raw or undercooked beef (Engels *et al.*, 2003)

It is difficult to diagnose in live animals, but if the animal is heavily infested, cysts may be felt on the tongue and face. The majority of cases are identified during visual inspection at slaughter, with samples sent to a laboratory for confirmation. If infection is

confirmed, the meat will be destroyed or frozen to inactivate the cysts and prevent transmission to people (USDA, 2014).

Carcass and viscera of an infested animal should be differentiated with those with “heavy” infestation and those with “light” infestation. Carcass and viscera of heavily treated either by boiling or freezing. The extent of “heavy infestation” is prescribed by the controlling authority. An animal is commonly considered heavily infected, if lesions are discovered in two of the usual inspection sites including the masseter muscles, tongue, esophagus, heart, diaphragm or exposed musculature and in two sites during incisions into the shoulder and into the rounds. Generalized infection according to Canadian regulations means 2 or 3 cysts found on each cut into the muscles of mastication, heart, diaphragm and its pillars, and also if 2 or 3 cysts are found in muscles exposed during dressing procedures. In moderate or light infestation consisting of a small number of dead or degenerated cysticerci, the carcass is held depending on the existing country regulations for approximately 10 days at -10°C (FAOAPHP, 2000).

Prevention and control methods should be geared towards either to avoid or reduce the risk factors associated with the transmission of taeniasis and cysticercosis. Measures employed in the control of taeniasis and cysticercosis include diagnosis and treatment of *Taenia* carriers, education of the mass to use latrines, avoid the consumption of raw meat serological testing of cattle and post-mortem inspection of carcasses for the presence of *Cysticercus bovis* (Wanzala *et al.*, 2003). Therefore, the objectives of this study were: to determine the prevalence of *Cysticercus bovis* and to assess some risk factors associated with it and to estimate the viability of *Cysticercus bovis* in different organ in Kombolcha ELFORA meat processing factory.

2. Materials and Methods

2.1. Study Area

The study was conducted at Kombolcha ELFORA meat processing factory from October 2015 to April 2016. Kombolcha is located in South Wollo Administrative Zone of Amhara Regional states Northern Ethiopia. The study area is located 375 km north of Addis Ababa (the capital of Ethiopia) with 110084'49'0"N latitude and 0.39047'46'E. longitude at altitude of 1840m above sea level. Kombolcha town experiences a bimodal rainfall, the short rainy season

usually occurs from March 15 to May 15. The minimum and maximum mean annual rainfall in Kombolcha ranges from 50mm to 750mm respectively. The average minimum and maximum daily temperature ranges from 11.7°C to 23°C respectively and the relative humidity of the area varies from 23% to 79%. According to South Wollo Zone and Kalu wereda agricultural and rural development office Kombolcha (2006) The livestock population comprises of 90,664 cattle, 12,975 sheep, 31,043 goats, 489 horses, 7,758 donkeys, 866 camel and 43,010 poultry (CSA, 2004).

Farming system in the area is a mixed type (crop-livestock production). The major crops grown in the area include sorghum, wheat, Teff, barley, maize, Oate, and others. The soil is vertisol which is deep. Topography of the zone generally marked by presence of numerous mountains, plateaus, hilly and sloppy 14% high altitude (Dega), 34% of mild altitude (Weynedega) and 52% low (Kola) (Kombolcha town agricultural office, 2006) .

2.2. Study Population

The study population was all bovine that come to Kombolcha ELFORA meat processing for slaughtering. Cattle of both sexes, with different body condition and age were sampled.

2.3. Sampling Method and Sample Size Determination

The sampling method was simple random sampling technique to select the animals and to determine the sample size. A total of 425 bovine were selected randomly. The source animals were from Rayakobo, Semen Gondar, Dessie zuria, Kombolcha, Batti, Afar and Kemisse. During the study period the veterinarian incise masseter muscle, Shoulder muscle and internal organs were used as indicator of *Cysticercus bovis* in the carcass. The sample was decided using the formula given by Thrusfield (2005) with 95% confidence interval and 5% desired absolute precision.

$$n = \frac{1.96^2 p (1-p)}{d^2}$$

Where, n=required sample size

p=Expected prevalence

d=desired absolute precision

According to the above formula, with 6.4% previously studied prevalence, the calculated sample size was 92.

However, in order to increase the accuracy, the number of sampled cattle was increased to 425.

2.4. Study Design

A cross-sectional study was conducted at Kombolcha ELFORA meat processing factory from October 2015 to April 2015 routine meat inspection procedure.

2.5. Study Methodology

Anti-mortem inspection: Using verbal interview at the abattoir, information on slaughtered was obtained from the abattoir purchaser the sex of the cattle at the lairage was determined using physical examination. Body condition of the cattle was determined by the method described by Nicholson and Butterworth (1986). And age of the animal was determined based on teeth eruption. Animals less than or equal to five year grouped under Adult and above five year recorded as old.

Postmortem inspection: The slaughter house was visited four times per week for 33 consecutive days; from October 2015 to April 2016. Palpation and visualization of organs followed by incision of organs was made to examine for the presence of *Cysticercus bovis*. For masseter muscle, deep line incision were made parallel to the mandible, the heart were incised from base to apex to open the pericardium and incision also made in cardiac muscle for deep examination, adjacent and parallel incision were made for Liver, shoulder muscle, diaphragm and longitudinal incision for tongue (MOA, 1972). All positive samples were transported to Kombolcha Regional laboratory parasitology department for confirmation of viability of cyst. The cysts were incubated in ox bile at 37 c for 1 - 2 hrs. Using 40% ox bile solution diluted in normal saline solution. After

this, the scolex was examined under microscope by pressing between two glass slides. The cysts were regarded as viable if the scolex was evaginated during the incubation period at the same time, the scolex is checked whether it is *T. saginata* metacestodes or others based on the size of *Cysticercus*, absence of hooks on the rostellum of the evaginated cyst (WHO, 1983).

2.6. Data Management and Analysis

Data were collected and recorded on Excel spread sheet and descriptive analysis such as prevalence of *C. bovis* associated with specific risk factors (Sex, BCS and age) was calculated to assess the strength of association of different risk factors to the occurrence of infection. Stastical analysis was done using SPSS version 20. Prevalence of *C. bovis* infection was calculated by dividing the number of animals examined having cyst by the total number of animals examined. In all analysis confidence level 95% $P < 0.05$ set for significance and $P > 0.05$ non significance.

3. Results

In the study period a total of 425 cattle were inspected in Kombolcha ELFORA meat processing factory from October 2015 to April 2016. From a total of examined cattle, 20(4.7%) were found to be infected to *Cysticercus bovis*. Regarding to age group higher prevalence was in adult 11(5%) and lower 9(4.4%) in old (Table1). *Cysticercus* with respect to sex revealed that higher prevalence 14(5.2%) in Female and lower prevalence 6(3.9%) in male (Table2). Related to body condition the highest prevalence was 8(6.1%) in poor followed by medium and good body condition score with a prevalence of 8(4.9%) and 4(3.1%) respectively (Table 3).

Table 1: Prevalence of *C. bovis* in relation to age

Age	No. inspected	No. infected	X^2	P -value
Adult	219	11(5%)	0.101	0.750
Old	206	9(4.4%)		

Table 2: Prevalence of *C. bovis* in relation to sex

Sex	No inspected	No infected	X^2	P -value
Male	271	14(3.9%)	0.353	0.552
Female	154	6(5.2%)		

Table 3: Prevalence of *C. bovis* in relation to body condition

Body condition	No of inspected	No of infected	X ²	P- value
Poor		8 (6.1%)		
Medium	162	8 (4.9%)	1.357	0.507
Good	132	4(3.1%)		

Heart was the most frequently infected organ with a prevalence of 4.2% followed by tongue (2.6%), masseter (2.6%), liver (1.2%) and 0.9% diaphragm

(Table 4). From the total of 49 cysts 27 (6.3%) were viable the remaining 22 (5.1%) were non-viable (Table 4).

Table 4: Anatomical distribution of *C. bovis* in different organs

Inspected organ	No of viable cyst	No of non- viable cyst	Total infected
Heart	12(2.8%)	6(1.41%)	18(4.2%)
Tongue	7(1.6%)	4(0.9%)	11(2.6%)
Masseter muscle	5(1.2%)	6(1.4%)	11(2.6%)
Liver	2(0.47%)	3(0.7%)	5(1.2%)
Diaphragm	1(0.23%)	3(0.7%)	4(0.9%)
Total	27(6.3%)	22(5.1%)	49(11.5%)

4. Discussion

In the present study out of 425 inspected cattle, 20 animals were positive with an overall prevalence of 4.7%. This finding is considered higher than the previous finding 2.5% Dawit Tesfaye *et al.* (2012) in Wolaita Sodo municipal abattoir, Meron Talu (2012) in Jimma town, Abate Worku (2014) in west Shewa zone, 2.6% Yacob Hailue *et al.* (2014) in Adama town, 0.2% Blessing *et al.* (2011) in South Africa and 1.05% Leonardo *et al.*(2012) in Brazil. In line with 4.9% Dawit Saddo (2004) in Gondar, 4.4% Bekele Megerssa *et al.* (2010) in Jimma municipal abattoir, 4.8% Karshima *et al.* (2013) in Nigeria, 5.6% Lielt Emiru *et al.* (2014) in Bishoftu, 5.73% Hylegebriel Tesfay and Alembrehan Assefa (2014) in Adigrat, 6.4% Tewodros Alemneh *et al.* (2010) in Kombolcha meat processing factory in the same study area and lower than 12% Abunna (2011) Yirgalem abattoir and 26.25% Abunna *et al.* (2007) in Hawassa municipal abattoir.

The above differences occur due to cysticerci were easily missed as they may not be present on routine cuts considering that most cases of *Cysticercus* are light infections. Moreover, observations indicated that except for the dead, degenerate or calcified cysticerci that usually from white and fibrotic lesions a careless meat inspector could most likely miss out quite a

number of viable cysticerci which blend the pinkish red color of the meat and be passed on for human consumption Garedaghi *et al.* (2012) and the variation of personal and environmental hygiene from area to area.

Regarding to sex group higher prevalence was recorded in female animals than male animals. This finding agrees with report of Ngwu *et al.* (2004) and Karshima *et al.* (2013). This is due to a reason of female animals are stressed during estrus cycle which causes hormonal imbalance and suckling of calves which weakens the immune system so leading to easily infection (Gracey *et al.*, 1999).

In the current study related to age group higher prevalence being recorded in adult animals (5%) than old (4.4%), this result was in agreement with the report of Dawit Tesfaye *et al.* (2012) and contradict with Nuradis and Few (2012). This is due to any age group of animal have close susceptibility but old animals are resistant to *Cysticercus bovis*. Animals with poor body condition were highly infected with *C. bovis* than those with medium and good body condition. It is easily to detect cysts from emaciated carcass and organs as compared to well-conditioned animals (Abunna *et al.*, 2011).

During the inspection period *C. bovis* is found in masseter muscle, tongue, heart, liver and diaphragm with the highest prevalence in heart (4.2%) in agreement with Dawit Tesfaye *et al.* (2012) and Hylegebriel Tesfay and Alembrehan Assefa (2014); and contradicts with Mesfin and Nuradis (2012) which is tongue was the most affected organ. This is due to blood kinetics and activity of muscle. *C. bovis* mostly found in muscles that have high blood supply and frequently movement. In confined animals *C. bovis* found in muscle of mastication, heart and diaphragm. Masseter muscle and tongue have equal prevalence (2.6%), muscle of mastication particularly masseter muscle and tongue equally important as a predilection site to cysticerci (Wanzala *et al.*, 2003). Diaphragm is the least prevalence recorded (0.9%), this is in line with Abunna *et al.* (2007); Dawit Tesfaye *et al.* (2012) and Lielt Emiru *et al.* (2015) this disagree with Bekele Megerssa *et al.* (2009), This variation occurs due to imperfect incision of organs. Related to viability, higher number of viable *Cysticercus* was recorded than non-viable cyst.

5. Conclusion and Recommendations

The current study revealed the presence of bovine cysticercosis in some cattle in Kombolcha ELFORA meat processing factory with a prevalence of 4.7%. This result was low from other endemic area because peoples have the awareness of using latrines and keeping sanitation

Therefore, in order to control and eradicate *Cysticercus bovis* in the country the following recommendations are forwarded:

- ✚ Up-graded the skill of meat inspectors to inspect meats should be legislated by Ministry of Agriculture.
- ✚ Infected carcass and organs should be undergo proper process of freezing, boiling based on the intensity of infection with cysticercoids.
- ✚ Back yard slaughtering activity and raw meat consumption should be avoid.

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