

Full Length Research Paper

Sheep and goats *Cysticercus tenuicollis* prevalence and associated risk factors

Endale Mekuria¹, Shihun Shimelis¹, Jemere Bekele² and Desie Sheferaw^{2*}

¹College of Veterinary Medicine, Haramaya University, P. O. Box 05 Hawassa, Ethiopia.

²School of Veterinary Medicine, Hawassa University, P. O. Box 05 Hawassa, Ethiopia.

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The purpose of this study was to estimate the prevalence of *Cysticercus tenuicollis*, identify factors that can influence its occurrence and to assess the distribution of the cyst in the visceral organs of sheep and goats slaughtered at Dire Dawa municipal abattoir. A total of 845 animals (425 sheep and 420 goats) were examined at the abattoir. The overall prevalence of *C. tenuicollis* was 24.6% (95% CI = 21.7 - 27.5) and 22.8 and 26.4% in sheep and goats respectively. Body condition of sheep was the only risk factor in which the prevalence of *C. tenuicollis* significantly varied ($\chi^2 = 19.353$, $P < 0.05$). Sheep with poor body condition (39.8%) were found most infected compared to medium (21.8%) and good (14.5%) body condition. There was no significant variation in the prevalence of *C. tenuicollis* between sheep and goats, because species mainly dependent on grazing, and hence, had equal exposure and opportunity to get infected. The cyst was found most frequently attached to liver, omentum and peritoneum both in sheep and goats. In conclusion, the presence of *C. tenuicollis* at a higher prevalence and the consequent effect on small ruminant signify the need for the control of stray dog population, deworming of dogs, and avoidance of backyard slaughter and proper disposal of infected viscera to curtail the problem.

Key words: Prevalence, *Cysticercus tenuicollis*, sheep and goats, Dire Dawa, Ethiopia.

INTRODUCTION

Cysticercus tenuicollis is the larval stage of *Taenia hydatigena*, which is a tapeworm of dogs, cats and wild canids (Kaufmann, 1996; Urquhart et al., 1996; Taylor et al., 2007). The intermediate hosts for the mature metacestode, *C. tenuicollis*, are sheep, goats, cattle, dromedaries, antelope, rarely pigs (Troncy, 1989) and also reported in deer and horse (Taylor et al., 2007) and monkey (Tsubota et al., 2009). Metacestode stage are frequently found attached to the omentum, mesentery and to the serosal surface of abdominal organs, especially liver (Taylor et al., 2007) and more frequently in the omentum of goats and sheep (EL-Azazy and Fayek, 1990; Radfar et al., 2005; Senlik, 2008; Samuel and Zewde, 2010). Normally, infection with *Taenia*

hydatigena is not very pathogenic in dog. The severity of infection depends on how many *Taenia* eggs the animal swallowed on a single occasion and the subject's age, young animals most susceptible. Severe infection of liver/tissues may result in liver/carcass condemnation at slaughter (Taylor et al., 2007). The prevalence of infection is considerably high in the world in some countries even more than 85% of sheep population was found to be infected with this metacestode (Garcia-Marin and Peris-Palau, 1987). Some studies indicated that the prevalence of *C. tenuicollis* increase with age (Togerson et al., 1998; Bhaskar et al., 2003) and other studies indicated that at the second age prevalence is increased and after that age the prevalence rates decreased

*Corresponding author. E-mail: mereba480@gmail.com. Tel. +251 916 83 24 19.

(Dajani and Khalaf, 1981; Senlik, 2008).

There was very few studies conducted, and hence, there is scarcity of information about *C. tenuicollis* prevalence or status in Ethiopia. Therefore, the aims of this study were to estimate the prevalence of *C. tenuicollis* and to identify factors that can influence the prevalence. Also to assess the organ distribution of the cysts both in sheep and goats slaughtered at Dire Dawa municipal abattoir.

MATERIALS AND METHODS

Study area

Dire-Dawa administrative city geographically lies within 9° 27' and 49°N latitude and 41°38' and 21°E longitude. The mean annual rainfall is 604 mm and the mean daily temperature is 25.4°C. It is generally characterized by semi-arid environmental condition, and has low amount of precipitation.

Study population

The study animals were sheep and goats slaughtered at Dire-Dawa municipal abattoir, and their sources were Dire-Dawa, Erer, Shinle and Eastern Hararghe areas. In the areas of their origin, the animals were owned by smallholder farmers under traditional management system. All selected animals were grouped into 2 age groups based on the number of pairs of incisors (Gatenby, 1991; Steele, 1996). Breeds of the study, sheep and goats were classified based on the phenotypic characteristics (Ayalew et al., 2004), and the body condition was scored following the guidelines set by Abebe (2007).

Study design and sample size

The study was cross-sectional study whereby the study animals were selected from the slaughter line using systematic random sampling technique. List of the animals to be slaughtered, from which study animals were selected, was prepared while the animals were kept in lairage. The required sample size was determined based on expected prevalence of 50% and the formula given by Thrusfield (2005). The study considered 95% confidence interval and 5% precision level. Accordingly a total of 845 animals (that is, 425 sheep and 420 goats) were selected and studied. For this study sex, age, species, breed, origin of animals and body condition were considered as risk factors.

Study methodology

The date and the species, origin, breed, sex, age and body condition of animals were recorded prior to slaughter. Then organs were thoroughly inspected by applying the routine meat inspection procedures during postmortem examination paying attention to the visceral organs and tissues in abdominal, thoracic and pelvic cavities (FAO, 1995; Gracey et al., 1999).

Data management and analysis

Collected data were stored in a Microsoft Excel spread sheet and analyzed with STATA version 11 (Stata Corp. College Station, TX) statistical software. Prevalence was calculated as percentage

value. Statistical association of *C. tenuicollis* prevalence with species, sex, age, body condition, origin and breeds of the animals was analyzed using χ^2 test.

RESULTS

Prevalence and associated risk factors

The overall prevalence of small ruminant *C. tenuicollis* was found to be 24.6% (95% CI = 21.7 - 27.5). From a total of 425 sheep and 420 goats examined by postmortem examination 22.8% sheep (95% CI= 18.9 - 27.1) and 26.4% goats (95% CI = 22.3 - 30.9) were found positive for *C. tenuicollis* infection. The association of the overall prevalence of *C. tenuicollis* with the considered risk factors was shown in Table 1.

The prevalence of *C. tenuicollis* in sheep and goats vs. the considered risk factors was shown in Tables 2 and 3.

Organ distribution of *C. tenuicollis*

In this study, the predominant predilection site for *C. tenuicollis* cyst was liver in both sheep and goats. Of the 97 positive sheep and 111 positive goats, liver accounts for 40.2% and 26.1% in sheep and goats respectively. The detailed for organ distribution of *C. tenuicollis* cyst was shown in Table 4.

DISCUSSION

Out of 425 sheep and 420 goats examined 22.8% (95% CI: 18.8-26.8%) and 26.4% (95% CI: 22.2-30.7%) were found to be positive for *C. tenuicollis*. This finding is comparable with the report of Senlik (2008) and Dada and Belino (1978) from Turkey and Nigeria respectively. The prevalence of *C. tenuicollis* in sheep and goats in this study is relatively lower than that reported from central Ethiopia (Samuel and Zewde, 2010) and in other countries (Radfar et al., 2005; Garcia-Marin and Peris-Palau, 1981). This variation in the prevalence mainly accounted to the grazing behaviour and management system prevailing in the local areas (Senlik, 2008). The study animals were selected from smallholder and backyard management system. In such areas dogs are kept by the animal owners, and believed that the dogs are useful for the community in preventing predators from their livestock. In the area, especially in rural, treating dogs for parasitic diseases is not practiced. Backyard slaughter of small ruminants and disposal of viscera and trimmings on open field is common. All these are very important for the life cycle to continue between the final and intermediate hosts. During this study there was no significant variation in the prevalence of *C. tenuicollis* between sheep and goats. This was mainly due to dependence of both species on grazing, and hence,

Table 1. Prevalence of *C. tenuicollis* at Dire-Dawa abattoir versus considered risk factors.

Factor	No. examined	Infected number	Prevalence (%)	95% CI	χ^2	P-value
Species						
Sheep	420	96	22.8	18.8 - 26.8	1.480	0.224
Goat	425	112	26.4	22.2 - 30.7		
Sex						
Female	406	96	23.6	19.5 - 27.8	0.396	0.529
Male	439	112	25.5	21.4 - 29.6		
Age						
Young	62	16	24.8	10.7 - 31.2	0.480	0.489
Adult	783	164	20.9	21.9 - 27.9		
Body condition						
Good	275	50	18.2	13.6 - 22.8	11.291	0.004
Medium	421	110	26.1	21.9 - 30.3		
Poor	149	48	32.2	24.7 - 39.8		
Animal origin						
East Hararge	267	65	24.3	19.2 - 29.5	1.350	0.717
Erer	111	23	20.7	13.1 - 28.3		
Dire-Dawa	333	84	25.2	20.5 - 29.9		
Shinilie	134	36	26.9	19.3 - 34.4		

Table 2. Prevalence of *C. tenuicollis* versus the considered risk factors in sheep.

Factor	No. examined	Infected number	Prevalence (%)	95% CI	χ^2	P-value
Sex						
Female	214	43	20.1	14.7 - 25.5	1.824	0.177
Male	211	54	25.6	19.7 - 31.5		
Age						
Young	23	4	17.4	1.5 - 33.3	0.407	0.523
Adult	402	93	23.1	19.0 - 27.3		
Body condition						
Good	145	21	14.5	8.7 - 20.2	19.353	0.000
Medium	197	43	21.8	16.0 - 27.6		
Poor	83	33	39.8	29.1 - 50.4		
Animal origin						
East Hararge	116	25	21.6	14.0 - 29.1	6.221	0.101
Erer	71	14	19.7	10.4 - 29.1		
Dire-Dawa	164	33	20.1	14.0 - 26.3		
Shinilie	74	25	33.8	22.9 - 44.7		
Breed						
Afar	91	22	24.2	15.3 - 33.0	0.157	0.925
Harar	73	17	23.3	13.5 - 33.1		
Black Head Ogaden	261	58	22.2	17.2 - 27.3		

Table 3. Prevalence of *C. tenuicollis* versus the considered risk factors in goats.

Factor	No. examined	Infected number	Prevalence (%)	95% CI	χ^2	P-value
Sex						
Female	192	53	27.6	21.2 - 34.0	0.251	0.616
Male	228	58	25.4	19.8 - 31.1		
Age						
Young	39	9	23.1	9.6 - 36.5	0.248	0.618
Adult	381	102	26.8	22.3 - 31.2		
Body condition						
Good	130	29	22.3	15.1 - 29.5	2.997	0.223
Medium	224	67	29.9	23.9 - 35.9		
Poor	66	15	22.7	5.2 - 32.9		
Animal origin						
East Hararge	151	40	26.5	19.4 - 33.6	3.562	0.313
Erer	40	9	22.5	9.4 - 35.6		
Dire-Dawa	169	51	30.2	23.2 - 37.1		
Shinilie	60	11	18.3	8.4 - 28.2		
Breed						
Somali	184	47	25.5	19.2 - 31.9	0.137	0.934
Afar	152	41	27.0	19.9 - 34.0		
Harar	84	23	27.4	17.8 - 37.0		

Table 4. Organ distribution of *C. tenuicollis* in visceral organs of sheep and goats.

Location	Sheep		Goat	
	Frequency	Proportion	Frequency	Proportion
Diaphragm	6	6.19	5	4.5
Liver	39	40.2	29	26.1
Liver and lung	1	1.0	-	-
Liver and peritoneum	1	1.0	2	1.8
Liver and omentum	2	2.1	2	1.8
Liver, peritoneum and omentum	-	-	1	0.9
Liver and pelvic cavity	-	-	1	0.9
Lung	8	8.3	10	9.0
Lung and peritoneum	1	1.0	-	-
Lung and pelvic cavity	-	-	2	1.8
Omentum	18	18.6	22	19.8
Omentum and pelvic cavity	1	1.0	1	0.9
Pelvic cavity	6	6.2	12	10.8
Peritoneum	13	13.4	22	19.8
Peritoneum and pelvic cavity	1	1.0	-	-
Peritoneum and omentum	-	-	2	1.8

they had equal exposure and opportunity to get infected.

The analysis of risk factors considered for this study showed no significant effect on the preference of *C.*

tenuicollis. Body condition of sheep was the only risk factor in which the prevalence of *C. tenuicollis* poor body condition (39.8%) were found most infected significantly

varied ($\chi^2 = 19.353$, $P < 0.05$). Sheep with compared to medium (21.8%) and good (14.5%) body condition. But among all other risk factors considered both in sheep and goats except the slight difference in figures of the prevalence statistically no significant variation ($P > 0.05$) observed (Tables 2 and 3). This finding is in line with the report of Togerson et al. (1998), Senlik (2008) and Samuel and Zewde (2010) from Northern Jordan, Turkey and Central Ethiopia respectively. When all studied animals considered together, still the prevalence significantly varied ($\chi^2 = 11.291$, $P < 0.05$) with body condition. Small ruminant with poor body conditions were the most affected compared to the medium and good body conditions. When animals suffer from shortage or scarcity of nutrition, and infected with gastrointestinal internal parasites their immunity compromised. Hence, possibly this can be accounted for the higher prevalence of the cyst in poor body condition animals.

Among the predilection sites observed during this study liver was found to be the predominant one, and it followed by omentum and peritoneum. Samuel and Zewde (2010) and Senlik (2008) reported that omentum is the predominant predilection sites for *C. tenuicollis*. The present study revealed that diaphragm and pelvic cavity was infected with *C. tenuicollis*.

CONCLUSION AND RECOMMENDATIONS

During this study high prevalence of *C. tenuicollis* was recorded both in sheep and goats slaughtered at Dire-Dawa municipal abattoir. Besides, the cyst was found distributed throughout the abdominal and pelvic cavities. It was found attached with many visceral organs and tissues, like liver, omentum, peritoneum, lung and diaphragm were the principal organ and tissues where the cyst was located. Hence, from the result of the current study the backyard slaughter of small ruminant should be discouraged, and the livestock health extension workers need to inform dog owners to deworm their dogs regularly. Controlling of stray dogs also play key role in the reduction of this high prevalence of *C. tenuicollis*.

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