



## Prevalence of *Coenurus cerebralis* in Small Ruminants Slaughtered at Selected Abattoirs in and Around Ada'a District, East Showa, Ethiopia

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**Key words:** Abattoir, Ada'a district, *Coenurus cerebralis*, prevalence, small ruminant

**Abstract:** A cross-sectional study was conducted in and around Ada'a district of Ethiopia from November 2018 to May 2019, with the aim of estimating prevalence of *Coenurus cerebralis* and identifying potential risk factors associated with the infection in small ruminants. A total of 200 small ruminants (79 sheep and 121 goats) were selected by systematic random sampling and recorded at antemortem examination. Brains were examined for the presence of *Coenurus cerebralis* during postmortem procedures. The overall prevalence was 10% with 25.3% in sheep and 0% in goats. Statistically significant ( $p < 0.05$ ) variation in the prevalence of the disease among species was observed. There was also association ( $p < 0.05$ ) between prevalence of cerebral coenurosis and origin of animals with 18.9% prevalence in animals originated from Mojo area followed by Somali regional state (14.3%) and none was detected in animals originated from Arsi, Borena and Harar. Twenty-one cysts were detected from infected animals of which 47.6% cysts were located in the left brain, 28.6% in the right brain and 23.8% in the middle brain. The average size of the cyst was 2.1 cm. In conclusion, the study confirmed a high prevalence of *Coenurus cerebralis* in small ruminants slaughtered at selected export and municipal abattoirs in and around Ada'a district. Therefore, awareness creation programs should be launched to the butchers, abattoir workers and dog owners about the transmission and control of the disease.

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## INTRODUCTION

Small ruminants are important domestic animals in the animal production systems of the world<sup>[1]</sup>. Especially, within the African society sheep and goat comprise a greater proportion of the total wealth of poor families

because of low input requirements such as small initial capital, fewer resources and maintenance cost, ability to produce milk and meat using marginal lands and due to they need only short periods to reconstitute flocks after disaster and respond quickly to the demand<sup>[2]</sup>.

Nowadays, small ruminant production enterprises are very attractive in the world market, this is due to small ruminants are sources of food such as milk and meat; provide 30% of local meat consumption, generate cash income from export of meat, live animal and skin; are adaptable to abroad range of environments; have short generation cycles and high production rate<sup>[3]</sup>. They have ability to produce milk and meat using marginal lands and poor pasture and due to they need only short periods to reconstitute flocks after disaster and respond quickly to the demand<sup>[4]</sup>.

Coenurosis, a fatal disease of sheep, is caused by the larval stage of *Taenia multiceps*. It is a parasitic disease that affects various livestock species including ruminants, horses, pigs and human beings, worldwide. *Coenurus cerebralis* is a bladder metacystode stage of *Taenia multiceps* which inhabit the small intestine of dogs and wild carnivores as the definitive hosts. Coenurosis is quite the commonly occurring disease in sheep compared to the other animals<sup>[5]</sup>. The disease may lead to lower production and even death of the animals in cases of heavy infestations<sup>[6]</sup>. The major economic losses associated to coenurosis of small ruminants for the export are brain condemnation, time and loss of energy to dissect the brain of small ruminants for export purpose during the, identification of the animal health<sup>[3]</sup>. The disease may also be a constraint for loss of productivity of small ruminants<sup>[4]</sup>.

Few earlier studies reported *Coenurus cerebralis* as a prevalent and endemic disease in Ethiopia<sup>[4, 3, 7]</sup>. However, there is still a paucity of information and comprehensive study is not available on coenurosis of small ruminants.

In addition, prevalence of *Coenurus cerebralis* in small ruminants slaughtered for export purpose at newly emerging export abattoirs in Ethiopia is not studied in detail. Therefore, this study was conducted to estimate the prevalence and identify the risk factors for the occurrence of cerebral coenurosis in sheep and goats slaughtered at selected municipal abattoirs in and around Ada'a district, Ethiopia.

## MATERIALS AND METHODS

**Study area:** The study was conducted from November, 2018 to May 2019 in and around Ada'a district. The area is one of the districts in East Showa Zone, Oromia National Regional State, Ethiopia. It is found nearest to the Addis Abeba and Adama town expressway (to the South of expressway). Bishoftu is the town of the district which is located approximately at 8°44'N latitude and 38°57'E longitudes, 47 km South East of Addis Ababa at an altitude of 1950 m above sea level with average annual range of 11.8-26.9°C and annual average rainfall of 851 mm<sup>[8]</sup>.

**Study animals:** The study animals were small ruminants (sheep and goats) originated from different parts of Ethiopia and slaughtered at municipal and export abattoirs in the study district during the study period. All study animals, irrespective of their origin, body condition, sex and species were considered for the study.

**Study population:** The study population constitutes local breeds of sheep and goats originated from different agro ecological zone of Ethiopia including Borena, Arsi, Harar, Somali regional state and Mojo areas coming for slaughter in the municipal and Export Abattoirs, located in and around Ada'a district.

**Sample size determination:** The sample size was calculated using the formula given by Thrusfield<sup>[9]</sup> with 8.3% expected prevalence<sup>[7]</sup>, 95% confidence interval and 5% desired absolute precision. Accordingly, 117 small ruminants were estimated for the study. However, 200 small ruminants were sampled to increase the precision of results.

**Study design:** Cross sectional study was used to determine prevalence of coenurosis in sheep and goats by antemortem inspection and post mortem examination of heads of small ruminants slaughtered at selected Abattoirs. Individual heads of slaughtered sheep and goats were separated from the carcass by ventral disarticulation of atlanto-occipital joint and after removal of the skin. The area just caudal to the frontal bone was cut cross-sectionally with large size knife gently and meanings incised then brains were sliced into thin slices with a scalpel blade in order to check the presence of cyst.

**Sampling procedure and study methods:** Systematic random sampling was employed to select study individuals at ante mortem inspection and then tag numbers of each selected animal was recorded for easy identification at postmortem examination.

**Ante mortem examination:** Ante-mortem inspection was conducted within 24 h of arrival of small ruminants at the slaughter house. Selected animals were inspected at lairage on the premises of the establishment where the cattle are offered for slaughter. Information about species, sex, body condition and origin of the slaughtered animals was registered prior to slaughter.

**Post-mortem examinations:** The heads of selected study animals were removed by disarticulation of the atlanto-occipital joint and after removal of the skin; the area just caudal to the frontal bone cut cross-sectionally, followed by two parallel cuts on the parietal bone. The bone was removed using a chisel and hammer and the meninges incised with a scalpel blade, so exposing the

brain. A detailed examination was made for gross pathological lesions. Cyst locations were recorded and their sizes were measured in floating condition using a caliper.

**Data management and analysis:** Date was entered in to Microsoft Excel spread sheet and coded properly. The coded data were analyzed using STATA version 13 statistical software (Stata Corp., College Station, TX) and Pearson’s Chi-square statistics was used to test the association between infection prevalence and potential risk factors such as species, sex, body condition and origin of slaughtered animals. A significant association was considered for  $p < 0.05$  at 95% confidence level.

**RESULTS**

Out of 200 small ruminants (79 sheep and 121 goats) examined after slaughter, 10% were infected and all were sheep that harbor at least one *Cysticercus cerebralis* (*C.cerebralis*) in their brain. The individual species prevalence was 25.3% (20/79) in sheep and 0% (0/121) in goat. The prevalence of *C. cerebralis* was higher in sheep 20(25.3%) than in goat 0(0%). This variation in the prevalence of *C. cerebralis* was statistically significant ( $p < 0.05$ ).

Based on the origin of animals the prevalence of *C. cerebralis* were 0(0%), 0(0%), 0(0%), 3(14.3%) and 17 (18.9%) in Arsi, Borana, Harar, Somali regional state and in and around Mojo area respectively. The maximum *C. cerebralis* prevalence was detected in animals originated from Mojo area (18.9%) and none was detected in animals originated from Arsi, Borena and Harar. There was statistically significant variation ( $p < 0.05$ ) in prevalence of the disease among the origin of animals (Table 1).

From twenty infected small ruminants, twenty-one *C. cerebralis* cysts were detected, of which, 10 (47.6%)

Table 1: Prevalence and associated risk factors of *C. cerebralis* in small ruminants

Risk factors	No. examined	No. positive (%)	95% CI	p-values
<b>Species</b>				
Sheep	79	20 (25.3)	16.2-36.4	0.000
Goat	121	0	-	
<b>Sex</b>				
Male	170	18 (10.6)	6.4-16.2	0.509
Female	30	2 (6.7)	0.8-22.1	
<b>Body condition</b>				
Poor	6	5 (83.3)	35.9-99.6	0.000
Medium	18	10 (55.5)	30.8-78.5	
Good	176	5 (2.84)	0.9-6.5	
<b>Origin</b>				
Arsi	38	0	-	0.000
Borana	30	0	-	
Harar	21	0	-	
Somali regional state	21	3 (14.3)	3.0-36.3	
In and around Mojo	90	17 (18.9)	11.4-28.5	
Total	200	20 (10)	6.2-15.0	

cysts were located in the left brain, 6 (28.6%) were located in the right brain and 5 (23.8%) were located in the middle (Table 2, Fig. 1 and 2). The size of cysts revealed a relatively large sized cyst in the middle brain as compared to those found in right and left. The overall average size of cysts was 2.1 cm (Table 2 and Fig. 3). Out of the examined *C. cerebralis* cysts; 7 (33.3%) have 1 cm diameter, 7 (33.3%) have 2 cm diameter size, 5 (23.8%) have 3 cm size and 2(9.5%) has 4 cm size (Fig. 3).

Table 2: Summary of cyst size and its relative location in brain of small ruminants

Variables	No. cyst (%)	Minimum	Maximum	Mean±SE
<b>Location</b>				
Left	10 (47.6)	1	3	1.8±0.3
Right	6 (28.6)	1	3	2.2±0.4
Middle	5 (23.8)	1	4	2.8±0.6
Total	21 (100)	1	4	2.1±0.2

SE = Standard Error

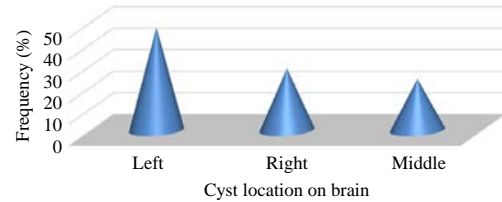


Fig. 1: Frequency distribution of *C. cerebralis* cyst location in small ruminants' brain

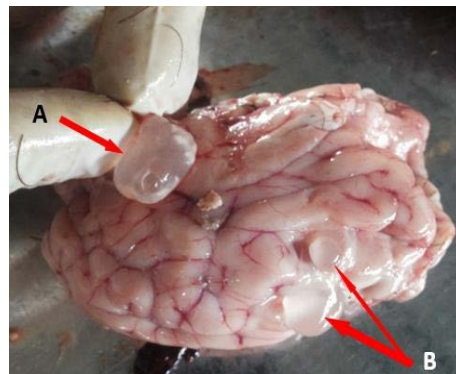


Fig. 2: Picture of *C. cerebralis* cyst in left (A) and right (B) sheep brain

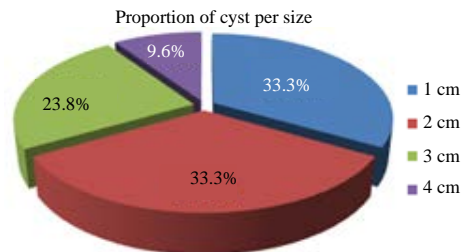


Fig. 3: Frequency distribution of *C. cerebralis* cysts size in relation to their number

## DISCUSSION

*Cerebral coenurosis* is an important parasitic disease in sheep and goats worldwide caused by intermediate stage of *Taenia multiceps* (*C. cerebralis*) and cause severe economic loss<sup>[10]</sup>. Cerebral coenurosis is an economically important disease as it causes serious problems in sheep industry and breeding<sup>[11-13]</sup>. Apart from being a cause of offal condemnation infection may lead to lower production and even death of the animals in cases of heavy infection<sup>[14]</sup>.

According to this study, the overall prevalence of coenurosis in small ruminant was 10%. The individual species prevalence was 25.3% in sheep and 0% in goat. This finding was in line with the findings of Adane *et al.*<sup>[3]</sup> who reported 3.78% overall prevalence of coenurosis in small ruminant where 2.5% was from sheep and 3.9% from goat in Bishoftu export and municipal abattoir, Ethiopia. Gicik *et al.*<sup>[15]</sup> reported 15.5% in sheep from Turkey Kars province which is in agreement with the current finding. This study revealed higher prevalence in sheep (25.3%) but the finding in goat is (0%) which greatly varies with the finding of Adane *et al.*<sup>[3]</sup>. The difference in prevalence of coenurosis among sheep and goat was highly significant ( $p < 0.05$ ) in the current study but Adane *et al.*<sup>[3]</sup> and Miran<sup>[16]</sup> reported insignificant association. Miran<sup>[16]</sup> reported a relatively higher overall prevalence of coenurosis in small ruminant (44.4%) in Ngorongoro district, Tanzania. It was 45.6% in ovine and 43.3% caprine<sup>[16]</sup> which is not in agreement and very high compared to the current finding. The most probable reason for the variation of the results in different countries is supposed to be due to variations in climatic, geographical management of the study animals and the final dog hosts health management practice and social conditions. The observed difference might also be due to the fact that the sampled animals originated from different localities within the same agro-ecological zones.

Concerning the number and location of *Coenurus* cysts in the positive cases; most of the cysts were located in the left (47.6%), followed by right (28.6%). A relatively small number of *C. cerebralis* cysts were detected in middle part of brain (23.8%). This finding was not in agreement with the reports of Miran<sup>[16]</sup> who reported 59.5% in the right, 35% in the left, 7.5% in the middle. On the other report by Gicik *et al.*<sup>[15]</sup>, 54.6% in the left and 40.2% in the right area of the lodgment of the coenurus cyst, this agreed with the present finding. This variation in lodgment of cyst suggests that there is equal chance of the cyst to be developed at any site of the brain<sup>[16]</sup>.

## CONCLUSION

Coenurosis was an important parasitic disease in sheep caused by the larval stages *C. cerebralis* and induced severe economic loss due to brain condemnation in Ethiopia. Inappropriate disposal of heads of small ruminants being practiced by some of the abattoirs could enhance the continuation of the life cycle of *C. cerebralis* between the intermediate (sheep and goats) and final hosts (dogs). This disease is distributed in all over the world and it is highly prevalent in Ethiopia. It causes great economic losses in sheep and goat production due to its direct effect of its high mortality and decrease in price for aesthetic purpose. The findings of present study showed that the disease is still at higher prevalence (20%) in small ruminants slaughtered in and around Ada'a district. Therefore, there is a need for regular deworming of dogs and prohibited feeding of undiagnosed head of slaughtered small ruminants to the dog. Moreover, awareness creation programs should be launched to the butchers, abattoir workers and dog owners about the transmission and control of the disease.

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