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Prevalence and Associated Risk Factors of Helminth Parasites of Small Ruminants Slaughtered at HELIMEX Abattoir, Ethiopia

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Abstract
A cross sectional study was conducted from October 2010/11 to April 2011/12 at Hashim Nur's Ethiopian livestock and meat export abattoir, with the aim to determine the prevalence of Helminth Parasites based on Coprological finding and post mortem examination of the organs and carcasses. During the study a total of 768 sheep and goat (384 each) were examined. Out of 768 animals examined, 426 were positive for the parasitic infection with the overall prevalence of 55.5%. The most commonly encountered parasites were: Fasciola, *St.hepatica,* Hydatid cyst, *C. tennuicollis*, C. *ovis, C. cerebralis* and *O. ovis.* The study indicated a higher prevalence of parasites like Fasciola 22(5.73%), *St.hepatica* 18(4.69%), Lung worm 186(49.44%), Hydatid cyst 13(3.39%), *C. Cerebralis* 13(3.39%) and *O. ovis* 22(5.73%) in Sheep. On the other hand, the prevalence of *C. tennuicillis* 49(12.76%) and *C. ovis* 4(1.04%) was higher in goats. Beyond economic loss, higher parasitic infections of sheep and goats are responsible for zoonoses. It is therefore worth conducting strategic regular deworming, careful ante and post slaughter examination and burning or burying of condemned organs and carcass to avoid access to dogs and wild canids to break down the transmission cycle.
Keywords: Sheep, Goats, Coprological, Post Mortem, gastro intestinal, parasites

INTRODUCTION

Ethiopia is a country with huge livestock population in Africa. The livestock resource contributes about 30-35% of agricultural gross domestic product and more than 85% of farm cash income and also it provides draught power for cultivation, the house hold meat and transport, milk and meat milk and its major source of cash and store of wealth for the rural population [1].

Small ruminants (sheep and goats) are important domestic animals in the tropical animal production systems. Within African society they comprise a greater proportion of the total wealth of poor families because of low input requirements (small initial capital, fewer resource requirement and maintenance cost) and ability to produce milk and meat using marginal lands and poor pasture. Furthermore, they need only short periods to reconstitute flocks after disaster [2, 3]

The livestock sub sector contributes much to the national economy. However, its development is hampered by different constraints like rampant animal diseases, poor nutrition, poor husbandry, poor infrastructure, and shortage of trained man power and lack of government policies [4].

Among the diseases, parasitic infections have greater economic impact, especially in developing countries. The losses due parasitic infections throughout the world are enormous and these losses are associated with mortality, morbidity, reduced growth, condemnations of organs and carcass, increased susceptibility to secondary infections and expenses to control measures. The loss is estimated to be > 900 million USD annually [5, 6, and 7].

The present study therefore, is aimed at estimating the prevalence of parasitic infections and the associated risk factors for the increased infections in sheep and goats brought from different parts of the country and slaughtered at Hashim Nur's abattoir.

MATERIALS AND METHOD

Study Area

The study was conducted at Hashim Nur's Ethiopian Livestock and Meat Export industrialized abattoir in Bishoftu town, Ethiopia. Bishoftu, is the capital of Ada'a Liben woreda and is a town and separate district located in the East Shewa zone at 47 kilometers South East of the capital city of Addis Ababa, on the main road to Adama. According to the population and housing census of 2007, the total population of the town was 100,114, of whom 52.1% were women. The absolute location of Bishoftu is 8°45′N latitude and 38°59′E longitude. Topographically the city is located in tepid to cool sub-moist mid highland at an altitude of about 1920 meters above sea level with moderate weather condition. The temperature of the area falls within a range of 16°c and 24°c. The mean relative humidity is 61.3% [8].

Arba Minch: Some of the small ruminants slaughtered at HELMEX abattoir were brought from Arba Minch Zuria Woreda, southern Ethiopia, which is located at about 500 km from Addis Ababa. The mean annual

temperature is 15-31°C. The soil type of area is also classified as sandy and clay-sandy soil [9].

Jinka: The study animals were also brought from South Omo Zone capital (Jinka) which is found in Southern Nation Nationalities and people Regional state (SNNP). The temperature of the area falls between 15.7°C and 38°C. The livestock resource of the zone is 2367712 cattle, 151499 sheep, 1881352 goats, 98545 equine, 1105053 poultry and 85,528 traditional beehives [10].

Borana: The study animals were also brought from Borana Zone which is situated at about 600 kms South of Addis Ababa. The area is bordered by Kenya from south, Somali regional state from east, highlands of Guji from the north and Southern Nation Nationalities and People Regional State from the west [11]. The climate is generally semi-arid with annual average rainfall ranging from 300mm in the south to over 700mm in the north. Annual mean daily temperature varies from 19°C to 24°C with moderate seasonal variation. Season affects herding patterns due to its effect on forage and water resources availability [11].

Study population

Study animals were randomly selected and identified by origin, species and age during ante mortem inspection. All animals were males.

Sample size determination

To calculate the total sample size, the following parameters were used: 95% level of confidence (CL), 5% desired level of precision and with the assumption of 50% expected prevalence, the sample sizes was determined using the formula given in Thrusfield

$$n = \frac{1.96^{2*} p_{exp}(1-p_{exp})}{d^2}$$

n = required sample size, Pexp = expected prevalence, d = desired absolute precision Therefore, based on the above formula the total sample sizes of sheep and goats were calculated to be 384 each. But to increase accuracy (minimize a bias resulting from smaller sample size) the (n) value is doubled and 384 each of sheep and goats is selected.

Study designs

A cross sectional study was conducted to determine the prevalence and the associated risk factors of gastro intestinal parasites based on Coprological finding and post mortem examination of the organs and carcasses. For this study a total of 768 sheep and goat (384 each) were randomly selected. The animals were classified into two age groups: young and adult based on eruption of one or more incisor teeth. Sheep having no erupted incisors are considered as young (under 1years and 3 months of age) but those having one or more pairs of incisors eruption are considered as adults (above 1years and 3 months of age). On the other hand, goats having no erupted incisors (having eight sharp incisors) are considered as young (< 1 years of age) and those in which their baby incisors replaced by two or more permanent teeth are considered as adult (>1 years) according to [3, 12].

Animals belonging to a group of young and adult were randomly sampled using systematic sampling method.

Coprological examination

Fecal samples were collected from the rectum of each animal and carried with ice box to Addis Ababa university veterinary parasitology laboratory for coprological examination. Samples were preserved using 10% formalin. During sampling, collection date, origin, age and their ID No was labled for ease of identification. The collected fecal samples were tested using direct and indirect fecal examination techniques (i.e. floatation, sedimentation and fecal culture)

Abattoir Survey

Ante mortem inspection

Pre-slaughter examination was conducted in the lairage by grouping the animals based on species, age and place of origin. Ante mortem inspections were conducted on individual animals, during entry and after they have entered in to the lairage in mass. They were inspected at rest and in motion for the general behavior, nutritional status, cleanliness, and sign of diseases and abnormality of any type were registered according to the standard ante mortem inspection procedures [13]. Animal fit for human consumption were allowed for slaughter as of the judgments of [14].

Post mortem examination

During postmortem inspection liver, lungs, heart, kidney, brain and carcasses were thoroughly inspected by visualization, palpation and making systemic incisions where necessary. Any tissue changes due to parasitic infection were differentiated and judged according to guidelines on meat inspection for developing countries. The results were recorded and the decisions at postmortem inspection are classified as: approved fit for human consumption, conditionally approved fit for human consumption, totally condemned as unfit for human consumption and partially condemned [14].

Data Management & Statistical Analysis

Data of the coprological examination were entered in a Microsoft excel spread sheet and summarized. Then analysis was done by using SPSS version 17 software of the computer programmed for the statistical analysis.

The chi-square (χ^2) test was used to assess the association of the frequency of GI parasites with different risk factors. Prevalence was calculated by dividing the number of positive animals by the total animals examined then multiplied by 100. The lower and upper limits of the 95% confidence interval for a proportion were calculated according to two methods described by [15, 16]

Result

Out of the total of 768 fecal samples collected and different internal organs examined post slaughter, 426 were positive of parasitic infection with the overall prevalence of 55.5%.

The prevalence of parasitic infection based on origin is shown on (Table1). As of the study, the higher prevalence was seen on sheep and goats originated from Borena with the value (60.4%) followed by Jinka (50.8%) and Arba Minch (48.6%).

Rate of infection by *F. hepatica, C. tennuicollis,* hydatid cyst, Lung worm and *O. ovis* was higher in adult sheep than in young with the respective values being 13(6.77%), 23(11.98%), 4(2.08%), 99(51.56%) and 4(2.08%). On the other hand, the prevalence of *C.teniculosis*, Lung worm and *C. ovis* was higher in adult goats than in young with the respective values of 28(14.58%), 115(59.90%), and 9(4.69%).

higher prevalence of *St. hepatica*, Hydatid cyst, *C. cerebralis and O. ovis* was seen in younger goats than in adults with the respective values being 8(4.17%), 1(0.52%), 1(0.52%) and 8(4.17%). Similarly higher prevalence of *C. ovis* was seen in young sheep than in adults with the value of 6(3.13%).

The present study indicated a higher prevalence of parasites such as *F. hepatica* 22(5.73%), *St. hepatica* 18(4.69%), Lung worm 186(49.44%), Hydatid cyst 13(3.39%), *C. cerebralis* 13(3.39%) and *O. ovis* 22 (5.73%) on Sheep.

There was a statistically significant difference on the value between species ($p<0.05$) except for *St. hepatica* whose value was insignificant ($p>0.05$). Conversely, the prevalence of *C. tennuicoillis* 49(12.76%) and *C. ovis* 4(1.04%) is higher on goats than sheep however there isn't significant difference on the values between species.

The prevalence of parasitic infection in different body condition groups is indicated on (Table 1). As of the study, higher infection was seen on shoats having poor body condition (68.75%) followed by those with medium (53.8%) and good body condition (26.8%).

Table 1. Prevalence based on origin

origin	No of animals examined	No of positive animals	prevalence	Chi- square	p-value
Borena	424	256	60.4	4.96	0.096
Arba minch	214	104	48.6		
Jinka	130	66	50.8		
Total	768	426	55.5		

Table 2. Prevalence among species

parasites	Caprine (384) (%)	Ovine (384) (%)	Total (768) (%)	Chi square(χ^2)	P- value
F. hepatica	4(1.04)	22(5.73)	26(3.39)	12.89	0.00
C. teniculosis	49(12.76)	44(11.46)	93(12.11)	0.30	0.58
St. hepatica	13(3.39)	18(4.69)	31(4.04)	0.84	0.35
Lung worm	216(56.25)	186(49.44)	402(52.34)	4.69	0.03
Hydatid cyst	2(0.52)	13(3.39)	15(1.95)	8.22	0.004
C. ovis	14(3.65)	11(2.86)	25(3.26)	0.37	0.54
C. cerebralis	2(0.52)	13(3.39)	15(1.95)	8.22	0.004
O. ovis	4(1.04)	22(5.73)	26(3.39)	12.89	0.00

Table 3. Prevalence based on body condition

Body condition	No of animals examined	No of positive animals	prevalence	Chi- square	p-value
Poor	288	198	68.75		
Medium	268	198	53.8		
Good	112	30	26.8	29.142	0.000
Total	768	426	55.5		

Table 4. Prevalence among age groups

	GOATS					SHEEP				
parasites	**Adult (192) (%)**	**Young (192) (%)**	**Total (384) (%)**	**Chi square(χ^2)**	**P-value**	**Adult (192) (%)**	**Young (192) (%)**	**Total (384) (%)**	**Chi square(χ^2)**	**P-value**
F. hepatica	2(1.04)	2(1.04)	4(1.04)	0.00	1.00	13(6.77)	9(4.69)	22(5.73)	0.77	0.38
C.teniculosis	28(14.58)	21(10.94)	49(12.76)	1.15	0.284	23(11.98)	21(10.94)	44(11.46)	0.10	0.75
St. hepatica	5(2.60)	8(4.17)	13(3.39)	0.72	0.397	9(4.69)	9(4.69)	18(4.69)	0.00	1.00
Hydatid cyst	0(0.00)	1(0.52)	1(0.26)	1.00	0.32	4(2.08)	3(1.56)	7(1.82)	0.15	0.70
Lung worm	115(59.90)	101(52.60)	216(56.25)	2.07	0.15	99(51.56)	87(45.31)	186(48.44)	1.50	0.22
C. ovis	9(4.69)	5(2.60)	14(3.65)	1.19	0.28	5(2.60)	6(3.13)	11(2.86)	0.09	0.76
C. cerebralis	0(0.00)	1(0.52)	1(0.26)	1.00	0.32	9(4.69)	9(4.69)	18(4.69)	0.00	1.00
O. ovis	5(2.60)	8(4.17)	13(3.39)	0.72	0.397	4(2.08)	3(1.56)	7(1.82)	0.15	0.70

DISCUSSION

During the present study period, the prevalence of gastrointestinal helminthes parasite in different geographical locations (Arba Minch, Borana and Jinka) were assessed during ante mortem fecal samples examination of sheep and goats at HELMEX abattoir.

As of the study, the most commonly encountered parasites were: *Fasciola hepatica & F. gigantica*, *Stelesia hepatica,* Hydatid cyst, *Cyticecus tennuicollis*, *cysticercus ovis, Coenurous cerebralis* and *Oestrous ovis.*

Coprological examination result revealed much higher prevalence of Strongyle eggs in the three different geographical locations as compared to other helminth parasites. The wide spread existence of these parasites as well as their higher prevalence in the study areas indicated their role in reducing productivity and health of small ruminants in the study areas [17].

The overall prevalence of Strongyle nematodes in the three different geographical locations were high compared to that of Fasciola species. Similarresults were reported by [18, 19] where the prevalence of Strongyle species was higher than that of Fasciola species. This may be due to the unfavorable environment and ecology of the rift valley area for Snail (Intermediate Host) development and survival of infective metacercaria.

Higher prevalence of Fasciola species *(F. hepatica & gigantica)* 22(5.73%), *Stelesia hepatica* 18(4.69%), Lung worm 186(49.44%), *Hydatid cyst* 13(3.39%), *Coenurous Cerebralis* 13(3.39%) and *Oestrus ovis* 22(5.73%) was observed on Sheep. On the other hand the prevalence of *Cysticercus tennuicillis* 49(12.76%) and *Cysticercus ovis* 4(1.04%) was higher in goats. Similar findings were reported at Gonder abattoir [20] and in goats slaughtered in Nigeria [21].

Cysticercus tenuicollis, Cysticercus ovis and *Stelesia hepatica* have no public health significance but they are important causes of economic loss in the meat industry due to fact that organs and carcasses of sheep and goats harboring them are rejected for aesthetic reasons. Moreover organs infected with these parasites /their larval stages/ are not accepted at international market. Improper disposal of the infected offal may allow some stray dogs and wild canids to have free access leading to the perpetuation of the life cycle between intermediate hosts and the final host [22, 23]. Besides this, the offal is sold at road side in the towns like Bishoftu to feed pets. This maintains perpetuation of the life cycle between the ruminants, dogs and human that may end in the establishment of the cystic disease [24].

The overall prevalence of fasciolosis in this study was 3.39% (26/768). The specific prevalence was found to be 22% (5.73) in sheep and 4% (1.04) in goats. Statistical analysis of the data showed that there was significant difference ($P<0.05$) on the prevalence of fasciolosis between, species. This result agrees with the finding of [25] who reported prevalence of 20.6% and 3.8% in sheep and goats, respectively. However, this result was lower than the value reported by [26] in Addis Ababa where the prevalence was 51% in sheep and 47% in goats. Similarly [27] in HELIMEX abattoir, reported the prevalence of 49% in both species.

The variation in the prevalence of fasciolosis among species may be explained by the fact that Sheep have indiscriminate type of grazing behaviour while Goats are selective grazers (browsers) which reduced the chance of exposure to infective infective metacercariae around marshy areas.

The rate of infection was higher in poor (68.75%) followed by medium (53.8%) and good body conditioned animals (26.8%) and statistical analysis of the value showed a significant differenceamong the three body condition scores($p<0.05$). This is in agreement with [26] where, higher prevalence was seen in poor body conditioned (83.3%) followed by medium (62.7%) and good body conditioned (6.2%) animals. Generally poorly nourished animals appear to be less competent in getting rid of infection although it is unusual for well-fed animals to succumb the disease in right environmental condition [27].

Regarding the relationship between parasitic infection and age of the animals, the rate of infection was higher among younger animals than adults and this result is in agreement with the one reported by [19]. This may be due to the development of immunity against the parasites in adults.

Most of the parasitic cases found in this study, have zoonotic importance. Among those, Hydatid cyst (larval stage of dog tapeworm, *E. granulossus*) is notable in that it causes blindness on humans when the cyst bursts into the eyes during meat inspection. Similar results were obtained at Gondar [20]. In addition, [21] isolated bacteria with public health significance from these condemned organs with possibility of contaminating

the carcass.

CONCLUSION & RECOMMENDATONS

The present study indicated higher prevalence of helminthes parasitic infection on randomly selected and examined sheep and goats. The high infection rate, beyond causing a great economic loss, it causes cross transmission of infection to human beings (zoonosis).

In line with this finding it is recommended that farmers who rear sheep and goats should improve provision of feeds to their animals so that the animal can have good body condition that confers some level of resistance against the infection. Besides, they should be able to regularly treat (deworm) their animals with the appropriate anthelementics and awareness should be created on the prevention and control methods.

Abbreviations

AB: Abebe Belete, BA: Birhanu Ayele ETB: Ethiopian Birr, FAO: Food and Agricultural Organization of the United Nation, HELIMEX: Hashim Nur's Livestock and Meat Export Abattoir, masl: meters above sea level, MA: Mihretu Ayele, MOARD: Ministry of Agriculture and Rural Development, TLU: Tropical Livestock Unit, UNDP: United Nations Development Program, USD: United States Dollar, WHO: World Health Organization

Authors' contribution

MA: conception of thesis title, designing of the study, data collection and organizing of the thesis up to the final version. AB: Data analysis and interpretation of results. BA: final edition and reviewing of the paper. All authors read and approved the final manuscript.

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