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Prevalence of ovine haemonchosis and associated risk factors in Jimma municipal abattoir

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Abstract
Haemonchus contortus is a blood sucking nematode parasite of sheep all over the tropics and subtropics which causes retarded growth, lower productivity and even mortality in young animals. A cross sectional study was conducted from April, 2018 to May, 2018 in sheep slaughtered at Jimma municipal abattoir in Jimma town conducted using purposive. Purposively, sheep were selected during ante-mortem examination and the necessary information was recorded in data collection format. In the present study, a total of 384 sheep (217 males and 167 females) were slaughtered at the Jimma municipal abattoir and inspected for the presence or absence of the parasite. Accordingly, the findings of this study revealed that an overall prevalence of 33.1% was recorded. High prevalence of disease occur in poor body condition score 117/245(47.8) and low prevalence occur in good body condition score 10/139 (7.2%) and there was statistically significant differences (P= 0.000) between body condition scores. Among the male and female slaughtered sheep, 70 (32.3%) and 57 (34.2%) were found to be positive for *H. contortus*, respectively; and shows no statistical significant difference (*P*>0.05) between sex. Based on age group, prevalence of haemonchosis was 57 (30.5%) and 70 (35.5%), in young and adult, respectively. The result from the present study indicated that there was no statistical significance (*P*> 0.05) among age groups. There is no statistical significance difference (*P*> 0.05) between urban and rural origin of sheep. In the present study, moderate prevalence of *H. contortus* was observed in sheep during the study period. Therefore, strategic prevention and control measures should be implemented to decrease the burden of the parasitic infection so as to enhance productivity of sheep in the study area.

Keywords: *Haemonchus contortus*, Jimma, prevalence, sheep

1. Introduction
Sheep population has become adapted to a range of environments from the cool alpine climate of the mountains to the hot and arid pastoral areas of the lowlands and easy to manage in small area because of sheep having docile nature (Mirkana, 2010) [36]. In Ethiopia, sheep are the second most important livestock species next to cattle and ranks second in Africa and sixth in the world (Gizaw *et al*., 2007) [22]. Sheep play an important economic role and make a significant contribution to both domestic and export markets through provision of food and non-food (skin and wool) products. They also play a major role in the food security and social well-being of rural populations living under conditions of extreme poverty (Duguma *et al*., 2010) [16]. Even though these sectors have major impact on the development of economy of the country, the sector receives little support and is hampered by various constraints including feeding and health problem. Among the diseases that constrain the survival and productivity of sheep, *Haemonchus contortus* infection ranks highest on a global index (Moges *et al*., 2017) [37].
Haemonchus contortus is a blood sucking nematode parasite, primarily occurring in the abomasum of small ruminants, notably sheep and goats. It has been ranked as the most important parasite of small ruminants in all regions across the tropics or subtropics (Domke *et al*., 2012) [15]. Haemonchosis is the disease caused by this nematode and is responsible for considerable economic losses. The parasite is important small ruminant production systems in tropical and subtropical regions of the world. Its reputation derives from a combination of high fecundity and a short generational interval that provides an enviable developmental plasticity for adaptation or resistance to control measures (Bowie and Emily, 2014) [7].
H. contortus is active mainly in warm, humid climates in the summer months. Adult worms colonize the abdominal mucosa of the sheep and feed on their blood.

The eggs they produce are secreted in the feces, hatch, and are ingested by the sheep through the consumption of grasses especially those that are short and covered in dew (Machen *et al*., 1998; Burke, 2005) [33, 11]. *H. contortus*, as the highest egg producer of all sheep worms, is one of the more devastating internal parasites (Besier, 2009) [4]. Haemonchosis, if untreated can lead to protein deficiency, anemia, bottle jaw, the swelling of the lower jaw as a result of anemia, general digestive disturbances and death (Williams, 2010) [58].

Haemonchus contortus infections are major constraint to the sheep industry and cause production losses, increased costs of management and treatment and even mortality in severe cases (Bowman *et al*., 2003) [9]. These parasites negatively affect the livestock industry. On global basis *H. contortus* probably causes more losses than any other species of nematodes in ruminants. Economic losses are primarily due to mortality, although losses in production can also be high. *H. contortus* causes retarded growth, low productivity, hematological and biochemical alterations, loss of appetite, loss of body weight, decrease in protein, impaired digestive efficiency and poor reproductive performance which can lead to loss of meat and wool among sheep (Zahida *et al.,* 2010) [59].

Essentially the pathogenesis of haemonchosis is that of an acute hemorrhagic anemia due to the adult *Haemonchus* and fourth stage larvae puncture small blood vessels of the abomasal wall, feeding on the blood. *Haemonchus* is thought to inject an anticoagulant into the wound so that the host actually loses more blood (Zelalem *et al.,* 2014) [60]. Each worm removes about 0.05 ml of blood per day by ingestion and seepage from the lesion. The pathogenesis of *H. contortus* results from inability of the host to compensate for blood loss to death (Taylor *et al.,* 2007) [49]. The disease caused by this parasite is prevalent wherever sheep are raised, but it exerts the greatest economic losses in temperate and tropical regions (Chaudhary *et al*., 2007) [12]. The disease has also found in the colder climates and recently been found as far north as the Arctic Circle (Tariq *et al.,* 2008) [47]. Despite the economic importance of this parasite and high population of ovine, yet there was no any previously documented data regard to the prevalence of haemonchosis in sheep in and around Jimma. Most previous studies in Ethiopia were based on coprological examinations which are less sensitive in identifying the nematode species. Therefore, detailed information is crucial to develop control and prevention strategies against the parasite. Therefore, the objectives of this study were:

- To determine the current prevalence of *Haemonchus contortus* of slaughtered sheep in Jimma municipal abattoir
- To identify some of the potential risk factors associated with haemonchosis in the study area

3. Materials and Methods

3.1 Description of the Study Area

The study was conducted from April 2018 until May 2018 for a total of 2 months at Jimma municipal abattoir. Jimma town, the capital of Jimma zone is located in Oromia Regional state, 346 km Southwest of Addis Ababa at latitude of about 7013º-8056ºN and longitude of about 35052º-37037º E, and at an elevation ranging from 880 m to 3360 m above sea level. The study area receives a mean annual rainfall of about 1530 millimeters which comes from the long and short rainy seasons. The annual mean minimum and maximum temperature were 14.4 and 26.7^{O}c, respectively (CSA, 2015).

Jimma zone is one of the zones with largest livestock population in Ethiopia with an estimated population of 2,200, 106 of cattle, 824, 208 of sheep and 411, 180 of goats, 92, 093 of horses, 20, 011 of mules, 71,880 of donkeys, and 570,241of beehive. Therefore, the area is well populated and dominant with different livestock population. Jimma Town have broadleaf forest, grasslands and wetland (marshes and swamps) and most common type of vegetation and maize, sorghum, teff, wheat and coffee is the most highly cultivated crop in the area (Jimma town Livestock and Fishery Resource Development Office, 2017).

3.2 Study Design and Sampling Strategy

A cross-sectional study was conducted in Jimma municipal abattoir using a purposive non random sampling technique to select the study sheep.

3.3 Study Animals

The study animals were all apparently healthy sheep of both sexes slaughtered in Jimma Municipal abattoir and came from different Peasant Associations (PAs) of Jimma town and surrounding district. All of them were kept under extensive management systems.

3.4 Sample size Determination

The sample size was determined using the formula described by Thrusfield (2005) [51] by considering an expected prevalence of 50% and an absolute precision of 5% with 95% confidence level, since there was no any study conducted in the area before.

$$N = \frac{1.96^2 \, Pexp \, (1\text{-}Pexp)}{d^2}$$

Where,

N = Sample size required for this study

D = Absolute desired precision

p = expected prevalence in the study area.

$$N = \frac{1.96^2 * 0.5(1\text{-}0.5)}{0.05^2} = 384$$

Therefore, the required sample size was 384.

3.5. Study Methodology

Active abattoir survey was performed. Sheep were selected purposively during ante-mortem inspection and tagged with temporal tag and followed during postmortem examination. During ante-mortem examination, detail records about breeds, sex, age, origins and body conditions of the animals was recorded in data collection sheet (Annex 1). Body condition was scored based on ribs observation (Craing, 2007) (Annex 2). During post-mortem inspection, each abomasum was properly examined and the findings were recorded on the data recording sheet coded during the ante-mortem inspection. Parallel to this, adult parasites were collected from abomasums of positive animals in universal bottle, labeled and shipped to the laboratory for further identification. Identification was done based on Urquhart (1996) [54].

3.6 Data Management and Analysis

Data obtained from both ante-mortem and post-mortem inspection was entered and stored in Microsoft (MS) Excel spreadsheet program and analyzed using SPSS software programs version 20. Univariable logistic regression was used to analyze the association of exposure variables with

Haemonchus contortus. Univariable associations were analyzed between the binary outcome variable and all independent variables. In all cases, 95% of confidence intervals and $P<0.05$ were set statistically significant.

4. Results

A total of 384 sheep were inspected for the presence or absence of adult *H. contortus*. The overall prevalence of haemonchosis in sheep was found to be 33.1% in the study area. In the present study, higher prevalence of haemonchosis was observed in female sheep (34.2%) as compared to male (32.3%). However, there was no statistical significant difference ($P>0.05$) between male and female sheep.

In current study, prevalence of haemonchosis was relatively higher in adult sheep (>3.5) than in young (<3.5) which was reported to be 35.5% and 30.5%, respectively. The difference was not statistically significant ($p>0.05$) (Table 1).

In this study, occurrence of *Haemonchus* parasite was highest in animals coming from rural areas of the Jimma zone (33.2%) as compared to animals from urban (32.9%). Thus, there was no statistically significant difference among origin of sheep ($P> 0.05$). This study reveals that higher prevalence of haemonchosis infection was observed in sheep with poor body condition score (47.8%) as compared to good body condition score (7.2%). The difference was statistically significant (P = 0.00).

Table 1: Univariate logistic regression analysis of Haemonchosis based on different risk factors

Risk factor	Number examined	Number positive	Prevalence (%)	OR	95%CI	p-value
Sex						
Male	217	70	32.3*	0.90	0.6-1.4	0.70
Female	167	57	34.2			
Age						
< 3.5	187	57	30.5*	1.30	0.8-1.9	0.18
>3.5	197	70	35.5			
Origin						
Urban	167	55	32.9*	0.98	0.64-1.5	0.74
Rural	217	72	33.2			
Bcs						
Poor	245	117	47.8*	0.22	0.13-0.38	0.00
Good	139	10	7.2			

5. Discussion

Based on the prevalence results of this study, *Haemonchus contortus* was one of major sheep health problem in study area. In this study, a total of 384 sheep were tested for the presence of parasite and the overall prevalence of *H. contortus* was 33.1%. This result was in line with the finding of Gadahi *et al.* (2009) [20] who reported a prevalence of 28.88% from Pakistan.

In the previous studies, various workers reported different prevalence rate of haemonchosis in different geographical areas. This prevalence may vary from country to country and even within the country. The overall prevalence of haemonchosis (33.1%) in the present study was higher than the previous studies reported by different researchers including Khaled *et al*. (2010) [31] from Egypt and Mesele *et al.* (2014) [35] from Mekelle Abergelle export abattoir who reported a prevalence of 7.9% and 26.8%, respectively. These variations in prevalence of haemonchosis in sheep in different parts of Ethiopia and different country may be due to the difference factors such as environmental factors, sample size, host factor, the standard of management and habits of anthelmintic usage which influences the development, distribution and survival of the parasite.

Prevalence of haemonchosis (33.1%) in the present study area was lower than previous studies. For example, a prevalence of 96.5% was reported from the arid and semi-arid zone of eastern Ethiopia by Abebe and Esayas (2001) [1], 91.2% in slaughtered sheep from Ogaden region at Debre-Zeit ELFORA abattoir reported by Kumsa and Wossene (2006) [32], 81.1% prevalence in small ruminants in Hawassa reported by Thomas *et al.* (2007) [50], 81.35% prevalence was reported from Komobolcha town by Ketama *et al.* (2011) [30], 1.03% prevalence from Finoteselam reported by Zelalem *et al.* (2014) [60], 56.25% of prevalence from Bahir Dar Municipal Abattoir reported by Moges *et al.* (2017) [37], 63.8% of prevalence from Arsi Negelle Municipal Abattoir reported by Tibeso and Mekonnen (2015) [52] and outside of Ethiopia different result was reported by Wang *et al.* (2006) [57] who reported 78% of prevalence in small ruminants from Heilongjiang, by Sabbas *et al.* (2012) [44] who reported a prevalence of 55.56% from Benin and by Asif *et al.* (2008) [2] who reported a prevalence of 80.64% in small ruminants from Pakistan. These variations are due to difference in climatic feature such as rainfall, humidity and temperature of each country. The presence of sufficient rainfall and moisture during the study period was favored the survival of infective larvae in pasture and higher probability of uptake of the infective larvae leading to higher prevalence. Other reason of high prevalence of haemonchosis in different study area may be due to the fact that free grazing with the high stocking density, where large numbers of animals graze together throughout the year in communal grazing land and inadequate nutritional status make prevalence of disease high.

In the present study, there was statistical significant variation in prevalence of *H. contortus* among different body condition scores. The highest prevalence was seen in poor body conditioned animals (47.8%) while the lowest was observed in good body conditioned animal (7.2%). Similar results were reported by Moges *et al.* (2017) [37] from Bahir Dar Municipal Abattoir, by Mesele *et al*., (2014) [35] from Mekele Abergele Export Abattoir and by Gonfa *et al*. (2013) [23] from Hemex-Export Abattoir Debre Ziet.

6. Conclusion and Recommendations

Haemonchus are the most damaging gastrointestinal worms for livestock in tropical and subtropical regions, particularly for sheep. The result of the present study indicated that *H. contortus* is an important disease in the study area with an observed prevalence of 33.1%. The prevalence of haemonchosis in this study area was statistically significant among animals with different body condition. Therefore

based on the above conclusion the following recommendations are forwarded:

- Animals should be kept in high plane of nutrition especially sheep in poor body condition in order to develop resistance against haemonchosis.
- Strategic deworming of the parasite should be focus on sheep at the beginning of the grazing period to prevent the contamination of the pasture, so prevent load of parasite in dry season.
- An appropriate control and prevention methods of haemonchosis should be designed.

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