

Full Length Research Paper

Study on calf coccidiosis in dairy farms in and around Holeta Town, Finfine Zuria Liyu Zone, Oromia, Ethiopia

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Received 27 July, 2017; Accepted 19 October, 2017

Bovine coccidiosis is a protozoan infection caused by different species of *Eimeria* which has a worldwide distribution. The disease which mainly affects calves belongs to large herd size where hygiene is not well managed and is associated with poor body condition. A cross-sectional study was conducted from November 2016 to April 2017 to determine the prevalence of bovine coccidiosis and identify the associated risk factors in semi intensive and extensive dairy farms in and around Holeta town, Finfine Zuria Liyu Zone, Oromia Regional State, Ethiopia. Fecal samples were randomly collected from three hundred and eighty four calves belonging to dairy farms and examined for the presence of the oocysts of *Eimeria* by floatation technique using saline solution. The study revealed that the overall prevalence of coccidiosis was 26.04%. The risk factors considered were age, sex, breed, production system, herd size, fecal consistency, body condition and hygienic status of the house. The prevalence of coccidiosis was higher within calves in poor hygienic (58.6%) dairy farms than calves from better hygienic farms (14.6%). There was also significant difference ($P<0.05$) in the prevalence of coccidiosis between different herd sizes with higher prevalence in herd size >10 animals (39.3%). The highest prevalence of coccidiosis was recorded in calves with diarrheic faeces (91.7%) than calves with soft, constipated and normal fecal consistency ($P<0.05$). Appropriate monitoring and control of the disease is advisable in the study farms.

Key words: Calf, coccidiosis, dairy farms, *Eimeria*, Holeta, prevalence.

INTRODUCTION

Ethiopia is endowed with abundant livestock resources of varied and diversified genetic roles with specific adaption to its wide range of agro ecologies (CSA, 2015). This great livestock potential is not properly exploited due to many prevailing socio economic values and attitudes,

traditional management methods, limited genetic potential and rampant disease.

Gastrointestinal parasite infections are a problem for both small and large scale farms; however, their impact is greater in sub-Saharan Africa. The prevalence of

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gastrointestinal parasites and the severity of infection vary considerably depending on the genera of helminth and protozoan parasites involved, animal species, local environmental conditions such as humidity, temperature, rainfall, vegetation and management practices (Debela, 2002; Sandhu and Singla, 2005; Wadhawa et al., 2011).

The most important disease problems in the young calf are pneumonia and diarrhea. The pathogens associated with calf diarrhea are rotavirus, corona virus, *Salmonella* species, protozoan parasites, *Eimeria* and *Cryptosporidium* species (Bhat et al., 2012; Brar et al., 2017). Bovine coccidiosis is a protozoan disease of the intestinal tract caused by microscopic organisms called coccidia; and is one of the most common and important disease of cattle worldwide (The Merck Veterinary Manual, 2005). This disease is usually the most known and devastating protozoan disease in calves under age of one year (Ernst et al., 1987).

Previous works which were conducted in different parts of Ethiopia showed that coccidiosis is a paramount important protozoan disease in younger calves (<12 months) which were kept in poor hygienic status as well as improperly nourished with colostrum (Abebe et al., 2008; Mehreteab et al., 2012; Alemayehu et al., 2013; Temesgen, 2016). Although, coccidiosis is an important cause of calf morbidity and mortality in Ethiopia in general, and in the study area in particular, there is no previous detail information on its prevalence coccidiosis in the study area.

Therefore, this study was conducted to determine the prevalence and associated risk factors of calf coccidiosis in farms in and around Holeta, Finfine Zuria Liyu zone, Ethiopia.

MATERIALS AND METHODS

Study area

The present study was conducted in extensive and semi intensive farms found in and around Holeta town located in Finfine Zuria Liyu Zone, Oromia Regional State, Ethiopia during the period between November 2016 and April 2017 to determine calf coccidiosis and its putative risk factors. Holeta is located 45 km west of Addis Ababa at altitude 2400 m above sea level. It is geographically located between 9° 3'N latitude and 38° 30' E longitudes. The area experienced bimodal rainfall pattern with a short rainy season from February to April and the long rainy season from the middle of June to end of September. The remaining months are dry periods. The area gets an annual rain fall of 1000 to 1100 mm and the annual temperature ranges between 18 and 24°C. The total cattle population of the study area is estimated to be 175,741, out of which 172,769 (98.3%) heads of cattle are local breeds and 2972 (1.7%) are crosses kept under extensive and semi intensive management systems (WoWAHA, 2015).

Study animals

The study was carried out on 384 calves within the age of 1 month to 1 year old. The samples were randomly collected from calves

reared under semi intensive and extensive management systems. Examined calves were categorized based on their age and grouped into three as: group I (1 to 4 months age), group II (5 to 8 months) and group III (9 to 12 months of age), based on house hygiene grouped into three (good, moderate and poor) and also based on size of herd grouped into three (<10, 11-20 and >20 head of calves).

Study design and sample size determination

The type of study was cross sectional with simple random sampling technique conducted between November 2016 and April 2017 to determine the prevalence and associated risk factors of calf coccidiosis in and around Holeta town. The desired sample size for this study was determined by using the single population proportion formula according to Thrusfield (2005). Since there is no previous report on calf coccidiosis in the study area, the sample size was established based on the 50% expected prevalence, 5% desired absolute precision and 95% confidence level (CI).

$$n = \frac{z * P_{ex}(1 - P_{ex})}{d^2}$$

Where, n = required sample size; z=1.96²; p_{ex} = expected prevalence; d = desired absolute precision.

Thus, the desired sample size for P_{ex} = 0.5 is n= 384 calves included in this study. While collecting faecal samples, data related to age, sex, breed, herd size management system, body condition, fecal consistency and hygienic status of barn were properly recorded.

Faecal sample collection and examination

A total of 384 faecal samples were collected directly from the rectum of each sampled animal with strict sanitation, and placed in air and water tight sample vials. After collection, the samples were transported in ice box to Holeta Agricultural Research Center (HARC) Parasitological Laboratory for fecal examination using simple floatation technique with saline solution (Yu et al., 2011; Gupta and Singla 2012).

Data management and analysis

All data collected were entered and managed in MS-Excel software program and analyzed using SPSS 20.0 statistical software version. Descriptive statistics such as percentage was used to approximate the prevalence of calf coccidiosis in the study area. Prevalence was calculated as number of positive calves harboring *Eimeria* oocysts divided by the total calves examined. Chi-square (χ²) statistics were used to test the association between variables. At p <0.05 was taken as statistically significant.

RESULTS

Overall prevalence

In the present study, out of total 384 samples tested, 100 (26.04%) were positive for the presence of *Eimeria* oocysts.

The prevalence was higher in Barfata (37.5%) as compared to other study localities (p <0.05) as shown in Table 1.

Table 1. Prevalence of calves Coccidiosis in the study localities.

Study locality	No. of animals examined	No. of positive	Prevalence (%)	χ^2	p-Value
Holeta	206	37	18	15.698	0.000
Barfata	98	37	37.5		
WajituHarbu	80	26	32.5		
Total	384	100	26.04		

Potential risk factors

The analysis of putative risk factors was made by Chi-square analysis. The result showed strong significant associations between coccidian infection and herd size ($\chi^2 = 16.387$, $P = 0.000$), different body condition scores ($\chi^2 = 51.447$, $P = 0.000$), faecal consistency ($\chi^2 = 44.668$, $P = 0.000$) and hygienic status of the house ($\chi^2 = 29.393$, $P = 0.000$). However, no significant difference was observed between the prevalence of coccidiosis and different age groups ($\chi^2 = 3.363$, $P = 0.186$), sexes ($\chi^2 = 0.437$, $p = 0.508$), breeds (0.103, $P = 0.748$) and different management systems ($\chi^2 = 0.281$, $P = 0.596$) as shown in Table 2.

DISCUSSION

Calf coccidiosis causes a significant economic loss through morbidity and mortality worldwide. The result of the present study conducted in three localities of Holota town and its environs showed an overall prevalence of 26.04% coccidian infection in calves. The 26.04% prevalence of coccidiosis in this study is in line with previous studies of Bekele et al. (2012) [22.7%] in Dire Dawa, Temesgen (2016) [24.3%] in South Wollo Zone Amhara region, Ethiopia, Toaleb et al. (2011) [24.2%] in Egypt. However, the prevalence result of the present study is much lower than many of the previous reports in Ethiopia, namely, 68.1% in Addis Ababa and Debre Zeit Dairy Farms (Abebe et al., 2008), 31.9% in Kombolcha, south Wollo (Alemayehu et al., 2013), 62.5% in Asella town (Ibrahim, 2016) and 38.9% in and around Asella town dairy farms (Tsegaye, 2016). The findings of this study are also much lower than that of other countries of the world. For instance, a prevalence of 47.1% was reported in China (Dong et al., 2012). The results of the present study, however, is higher than previous reports by Gillhuber et al. (2014) (13.3%) in Southern Germany, Hussin (2016) (9.5%) in Iraq and Das et al. (2015) (11.9%) in India. Such inconsistency in the prevalence rate of coccidiosis may be due to the variation in diagnostic tests, age of the animals, susceptibility of different breeds to the disease, stress level, handling, climatic and other factors of agro-ecology, variation in the study season, number and target group of the study animals and husbandry practices (Radostitis et al., 2007a; Abebe et al., 2008; Heidari et al., 2014).

This study showed variation in the prevalence of calf coccidiosis between different study localities (18% to 37.5%). Similar results were obtained in different parts of Zimbabwe (17.4 to 32.6%) (Pfukenyi et al., 2007), Al-Baha, Saudi Arabia (29.84 to 32.51%) (Ibrahim et al., 2015) and in Addis Aababa and DebreZeit, Ethiopia (57.2 to 76.4%) (Abebe et al., 2008). This geographical difference in distribution of positive cases could be explained by the management practices and the bio-security followed by the farm owners.

Analysis of risk factor with regard to the age of the calves revealed that there is no statistically significant association ($\chi^2 = 3.363$, $P = 0.186$) between the age of the calves and coccidian infection. This result agrees with the reports of Abebe et al. (2008), Tsegaye (2016), Alemayehu et al. (2013), Bekele et al. (2012) and Gillhuber et al. (2014). This similarity could be due to the fact that animal husbandry practices in the study areas are identical, and also, different age groups were kept and housed together without separation.

There was no statistically significant difference in prevalence of coccidian infection between male and female animals ($\chi^2 = 0.437$, $p = 0.508$), which is in agreement with the reports of Abebe et al. (2008), Heidari and Gharekhani (2014), Alemayehu et al. (2013) and Ibrahim (2016). This might be associated with the fact that different sex groups kept in similar husbandry system might have equal chance of accessing the oocysts. Despite this, previous studies done on adult cattle showed higher prevalence of *Eimeria* in female animals than in males (Manya et al., 2008; Rehman et al., 2011). Nevertheless, this could be attributed to the physiological stress loaded on female animals in relation to pregnancies and giving birth as compared to males (Radostits et al., 2007a).

The breed related prevalence of coccidian infection in the present study showed no statistical significant difference between breeds ($\chi^2 = 0.103$, $p = 0.748$), which is in agreement with the findings of Abebe et al. (2008) and Alemayehu et al. (2013).

The possible explanation for this similarity could be the fact that calf rearing condition in the study areas was identical and different breeds were housed together without separation. In contrast to the current findings, susceptibility differences were reported between local and cross breeds (Ibrahim, 2016). This breed susceptibility difference could be related to the dose of oocysts ingested and the species of *Eimeria* involved in

Table 2. Prevalence of calf coccidiosis in relation to various risk factors.

Risk factor		No. of sampled calves	No. of positive	Prevalence (%)	χ^2	p-Value
Age (Months)	1-4	204	58	28.4	3.363	0.186
	5-8	102	28	27.5		
	9-12	78	14	17.9		
Sex	Female	208	57	27.4	0.437	0.508
	Male	176	43	24.4		
Breed	Local	124	31	25	0.103	0.748
	Cross	240	69	26.5		
Herd size	≤10 Animals	92	22	23.9	16.387	0.000
	11-20 Animals	117	46	39.3		
	>20 Animals	175	32	18.3		
Management	Semi intensive	296	79	26.7	0.281	0.596
	Extensive	88	21	23.9		
Body condition score	Good	171	20	11.7	51.447	0.000
	Moderate	164	50	30.5		
	Poor	49	30	61.2		
Fecal consistency	Normal	302	59	19.5	44.668	0.000
	Soft	67	28	41.8		
	Constipated	3	2	66.7		
	Diarrheic	12	11	91.7		
Barn hygiene	Good	164	24	14.6	29.393	0.000
	Moderate	191	59	30.9		
	Poor	29	17	58.6		

the infection (Taylor et al., 2007).

In the current study, coccidian infection was significantly higher in calves reared in large herd size than in small size ($\chi^2 = 16.387$, $P = 0.000$). This finding is in line with the report of Nasir et al. (2009). This similarity might be due to rapid spread of infection from calf to calf as well as greater contamination of feeding and watering troughs when animals are communally feed and overcrowded (Radostitis et al., 2007a). However, the current finding disagrees with that of Abebe et al. (2008). This variation might be due to the differences in the study seasons, husbandry practices and the treatment regime given to the calves.

There was no significant difference ($\chi^2 = 0.281$, $p = 0.596$) in the prevalence of coccidiosis and management systems. This result agrees with the report of Abebe et al. (2008), Alemayehu et al. (2013) and Temesgen (2016). This similarity might be due to equal chance of accessing the oocysts when grazing from contaminated field.

However, the current finding is in contrast with the previous report of Abisola (2004). This variation might be due to hygienic condition of the barn, nutritional status of the calves, contamination level of the feed, water, floor and treatment given to the animals.

There was statistically significant ($\chi^2=44.668$, $P=0.000$) difference in prevalence rate between fecal consistency and coccidian infection which agrees with the findings of Pundit (2009) and Alemayehu et al. (2013). However, this finding disagrees with the report of Abebe et al. (2008). In the present study, 91.7% diarrheic calves were found to be positive to *Eimeria*. However, there were no apparent clinical signs in most of the animals sampled for the study.

A strong significant association ($\chi^2= 51.447$, $P= 0.000$) was recorded between body condition score and coccidian infection in the current study. Similarly, Mehreteab et al. (2012) reported a higher infection rate in calves with poor body condition score than in calves with

good and moderate body condition score. This might be due to the weak immune status of the calves with poor body condition score. As a result, malnutrition and other parasitic infections result in immune compromised calves. This condition produces a higher infection rate in poor state animals than in good-state animals (Radostits et al., 2007b).

In the current study, association of *Eimeria* infection in relation to the hygienic status of calf house was verified ($p < 0.05$). This result agrees with the report of Bekele et al. (2012) Mundt et al. (2005a, b) and Dawid et al. (2012). The similarity implies that poor sanitation in the calving and calf housing areas as well as poor management of housing favors infection of coccidiosis. Obviously, poor ventilation, droughts, poor calf nutrition, group pens, heavy stocking, cows present with calves, soiled bedding are regarded as risk factors for coccidiosis (Radostits et al., 2007b).

CONCLUSION AND RECOMMENDATION

In conclusion, this study provides proof of a coccidian infection in dairy farms in Holeta and its environs. Hygiene of calf's house can be considered as a risk factor for the occurrence of coccidia. Large herd size, diarrheic faeces and poor body condition of the calves also increased the risk of infection with coccidia. However, sex, age, breed and management system of calves did not show any difference with the occurrence of protozoan parasite infection. In general, different risk factors were considered to affect the rate of infection of calves with this protozoan parasite.

Based on these findings, it was recommended that calves with severe diarrhea be isolated and treated with appropriate drugs; any possibility of fecal contamination of the farm and the calves be minimized. Further epidemiological investigations are required to determine the protozoan parasite species composition and their economic impact.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

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