

Prevalence and Associated Risk Factors of *Eimeria* Infections in Dairy Calves in Haramaya University, Haramaya and Harar Towns

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Abstract

A cross sectional study was conducted from November 2014 up to March 2015 in Haramaya University, Haramaya and Harar towns to determine the prevalence of *Eimeria* infection in calves. Fecal samples were collected from a total of 266 calves between the ages of 1 day to 6 month. Samples were examined for the presence of *Eimeria* oocyst by flotation techniques. Out of 266 calves, 65(24.4 %) were found to be positive for *Eimeria* infection. There were statistically significant differences ($p < 0.05$) in the prevalence of *Eimeria* between calves with different fecal consistency, hygienic status of the farm and calf housing. Diarrheic calves had significantly higher prevalence than calves with soft and normal feces. Poor hygienic status in the farm increased the prevalence of *Eimeria* infection and calves kept mixed with other animals of the herd had higher prevalence (35.33 %) of *Eimeria* infection than calves separately housed (13.53 %) with their peers. No statistically significant prevalence difference ($P > 0.05$) was observed between calves of different sex, age and farm size. In conclusion, the study revealed that calf eimeriosis was prevalent in Haramaya University, Haramaya and Harar towns Dairy farms and consequently affects the productivity of the sector. Hence, appropriate disease prevention and control measures are required to be undertaken to reduce its effect.

Key words: Calves; Coccidiosis; *Eimeria*; Associated risk factor; Haramaya; Harar town

Introduction

Eimeria infections are one of the most common and important disease of cattle worldwide. Bovine coccidiosis has been observed in almost all areas where cattle are raised and is usually most common and important in calves younger than 1 year. All calves managed under conventional systems are exposed and become infected early in life. At least 13 different coccidial species are known to infect cattle, but not all are pathogenic. The two most pathogenic species are *E. bovis* and *E. zurnii* [1].

Many studies indicated that under natural conditions, mixed species infections are much more common than mono-species infections [2]. Eimeriosis in cattle is particularly a problem of confined animals kept under intensive husbandry practices. The

disease is more common in housed animals than in those on pastures. In associations with other enter pathogens, coccidia have been indicated as an important cause of diarrhea in calves [3].

All age groups of cattle are susceptible to infection, but clinical eimeriosis is most common in young animals. Coccidiosis in cattle commonly occurs as subclinical disease without signs of the disease and involving great economic losses due to reduced appetite, reduced body weight, impaired feed conversion, unthriftiness, diarrhea, dysentery, anemia, and increased susceptibility to other diseases [4].

The development of clinical coccidiosis in cattle mainly depends on factors like species of *Eimeria*, age of infected animal, number of oocysts ingested, presence of concurrent infections, and type of production system and management practices [5]. Compared to clinical coccidiosis, subclinical coccidiosis is economically more important and may account for over 95 % of all the losses associated with coccidiosis and can cost cattle ranchers more than US\$400 million per annum. It can also delay growth of calves by as much as 2 months [6]. A number of epidemiological factors like moisture, temperature, and oxygen tension influence the pattern of the disease [7]. In addition, stress factors like weaning, change of diet, harsh environment, poor nutrition and sanitation, and overcrowding can increase level of infection and incidence of the disease due to stress-induced immune suppression [8]. Thus determination of prevalence, species composition, associated risk factors, and animal management and husbandry practices is very useful in designing efficient control strategies [9].

The prevalence, species composition, and importance of bovine coccidiosis have been documented in various countries of the world; however, there is scarcity of reports on animal morbidity and mortality in Ethiopia. Particularly in Eastern Hararghe, a single study available on the coccidia of cattle, reported an outbreak of coccidiosis due to *Eimeria* species with an overall prevalence of 22.7% in dairy farms in Dire Dawa [10]. As a result, there is paucity of information on the occurrence and

losses associated with bovine *Eimeria* infection and very little attention has been given to the role of coccidiosis as the cause of disease and production losses in cattle in Eastern Haraghe Zone. Moreover, no attempt was made to determine the prevalence, and associated risk factors of *Eimeria* infections in cattle.

Therefore, the current study was designed:

- To estimate the prevalence of *Eimeria* infection in dairy calves in Haramaya University, Haramaya and Harar towns
- To identify and give recommendations on potential risk factors of *Eimeria* infections.

Materials and Methods

Study Area Description

The study was conducted in dairy farms in Haramaya University, Haramaya and Harar towns which are found in Eastern Haraghe Zone, Eastern Ethiopia. These sites are approximately 511 km, 506 km, 523 km East of Addis Ababa respectively. The elevation of the first two farm is about 2000 m above sea level and geographically located at 09°10'24" N and 41°59'58" E (HADB, 2009), whereas Harar dairy farm is located at 09°11'49" N longitudes and 42°03'03" E longitude (HAOR, 2002). Haramaya University receives an average rainfall of approximately 900mm, and agro-climatically found at highland areas [11]. Harar receives annual rain fall ranges between 275-1000mm, and climatically found at midland (*woynadega*).

Study Animal

The study animals were calves between the ages of 1 day to 6 month old. A total of 266 fecal samples were collected and examined for *Eimeria* infection from different dairy farms in Haramaya University, Haramaya and Harar towns. Examined animals were categorized into two age groups as group I= 1day to 3 months age and group II= 3 to 6 months age which was determined by asking the owner of the animal orally [12].

Study Design

A Cross-sectional study was conducted from November 2014 to March 2015 to determine the Prevalence and risk factors of *Eimeria* infections in dairy calves in Haramaya University, Haramaya and Harar towns.

Sample Size Determination

The sample size required for this study was calculated based on sample size determination method for simple random sampling of infinite population [13] as follows:

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

Where n=required sample size:

P_{exp} = expected prevalence

d= desires absolute precision

Previous study undertaken in Dire Dawa in similar region to

the current study reported prevalence of 22.7 %, [10]. Therefore, this was taken as a basis for calculation of sample size. Accordingly, with 5 % absolute precision at 95 % confidence level, the number of calves required to determine the prevalence was found to be 266. Then, simple random sampling method was used to select the calves from dairy farms.

Study Methodology

About 10-20 g fresh faecal sample was collected per rectum from each calf using sterile disposable plastic gloves. Each sample was placed in a clean plastic container labelled and transported to Veterinary parasitology laboratory, College of Veterinary Medicine, Haramaya University on the same day of collection, and preserved at refrigeration temperature until processing within 24 hours of arrival. At the time of sampling, the name of the farm, date of sampling, consistency of the feces (soft, watery, or normal), age, sex, breed, calf housing, and hygienic status of farm and tag number was recorded for each calf on a recording format.

A 3g portion of each of the 266 fecal samples collected was weighed out using a balance and put in a mortar. After grinding with pistil 40ml of sugar solution (specific gravity 1.27) was added, mixed thoroughly and poured into a 100-ml glass beaker through a strainer. Then it was rinsed and the solution was poured into 15-ml centrifuge tubes but not filled. After centrifugation at 1,500 rpm for 5 min, more sugar solution was added until a convex meniscus was formed on top of the tube. A glass cover slip was placed on top of each tube and was left for 30 min. Then, each glass cover slip was briskly lifted up and placed on a clean glass slide, not allowing formation of air bubbles. The entire area under each cover slip was examined under a binocular microscope at 40× magnification [14].

Data Analysis

Data collected from study sites were entered and stored in a Microsoft excel spread sheet program and coded for analysis. Statistical analysis was done on STATA 11.0 version statistical software. The prevalence was calculated for all data as the number of infected individuals divided by the number of sampled individual and multiplied by 100 For the purpose of this study, animal attributes such as age, sex, consistency of feces, hygiene, farm size, and calf housing were considered as risk factors [13]. Categorical data were analyzed first with the chi square (χ^2) test for independence as a screening process. A P-value < 0.05 was considered as statistically significant.

Result

Overall Prevalence of *Eimeria* Infection in Calves

Out of 266 fecal samples examined, 65 were positive for *Eimeria* oocysts and hence the overall prevalence was found to be 24.4 %. Accordingly, the prevalence of *Eimeria* infection relating to hygiene, consistency and calf housing were found to be significantly different ($p < 0.05$) other factors such as age, sex and farm size were not significantly different (Table 1)

Table1: Prevalence and analysis of potential risk factors for the occurrence of *Eimeria* infection in calves

Risk factors		No. observed	No. Positive (%)	95% CI	X ²	P-value
Consistency	diarrhic	78	33(42.3%)	31.2-54.0	19.109	0
	normal	127	22(17.32%)	11.8-25.0		
	soft	61	10(16.39%)	8.2-28.1		
Age	≤3month	149	32(21.48%)	15.8-28.9	1.6069	0.205
	>3month	117	33(28.2%)	2s0.3-37.3		
Sex	Female	153	42(27.45%)	20.6-35.2	1.7729	0.183
	Male	113	23(20.35%)	13.7-29.0		
Hygiene	Poor	117	41(35.04%)	26.5-44.4	12.726	0
	Good	149	24(16.10%)	10.6-23.0		
Farm size	Large	118	27(22.9%)	15.7-31.5	0.2805	0.869
	Medium	94	24(25.53%)	17.1-35.6		
	Small	54	14(25.9%)	15.0-39.7		
Calf housing	Separated	133	47(13.53%)	8.22-20.54	17.1225	0
	Mixed	133	18(35.33%)	27.3-44.1		

Discussion

The overall prevalence of *Eimeria* in calves recorded in this study (24.4%) was lower than previous reported in Addis Ababa and Debre Zeit by which was 68.1 % [12]. Also the prevalence of the present study was lower than previously reported in other countries by in turkey; in Canada; and in Mexico, who reported 68 %, 64.2 % and 87.8 % respectively [15,16,17]. However, the result of the present study was in agreement with the previous studies conducted in Ethiopia by in Bahir Dar; in Debre Zeit; Dawid *et al.* (2012) in Dire Dawa and in Kombolcha who reported 24.9 %, 20 %, 22.7 %, and 31.9 % respectively [10,18,19,20]. Also it was in agreement with report in other country by in Egypt which was 24.2 % [21].

The lower prevalence of coccidiosis recorded in this study as compared to the areas with the higher prevalence could be due to the differences in agro-ecology, management types and husbandry practices of the study animals in different countries. Moreover this could also be due to the fact that the study has been undertaken mainly in dry season; hence, higher prevalence would have been recorded if the study was carried out in the rainy season. Warm moist conditions favors fast development of oocysts, which means that irrespective of season in different parts of the year maximum transmission, will occur under these conditions.

Analysis of risk factor in the association of disease occurrence has revealed that there was no statistically significant difference ($P>0.05$) in prevalence between sex and *Eimeria* infection. These indicate that the sex does not have influence on the occurrence of *Eimeria* infection. This is due to either equal chance of accessing the oocysts or no difference on protective immunity for the disease.

There was no significant difference ($P>0.05$) between the age of the calves with the risk of infection. However, the prevalence

was somewhat higher in calves 3-6month age than ≤3month old. This is in line with the study by who reported that risk of infection by *Eimeria* species appeared to increase with the age of the examined calves [12]. This is true only for young calves, because *Eimeria* infection is most common in young cattle [3].

There was a statistically significant difference ($p<0.05$) in prevalence of *Eimeria* infection between farms with different hygienic status. Consequently, calves belonging to the farms with poor hygiene showed significantly higher prevalence than calves belonging to the farms with relatively better hygiene. This could imply that poor sanitation in the calving and calf housing areas as well as poor management of housing favors infection with Eimeriosis. Obviously, poor ventilation, draughts, poor calf nutrition, heavy stocking, soiled bedding were regarded as risk factors for Eimeriosis [22].

There was statistically significant ($P<0.005$) difference in prevalence between fecal consistency with *Eimeria* infection which agrees with the finding of [23]. However, this finding disagrees with the report of [12]. In the present study, 42.3 % (33/78) of diarrhetic calves were found to be positive for *Eimeria*. However, there were no apparent clinical signs in most of the animals sampled for the study.

Absence of statistically significant difference between the herd sizes of the study animals might suggest equal likelihood of being infected with coccidiosis. However in this study the prevalence was bit higher in small herd size than large and medium herd size. This could be due to difference in calf housing, where most calves in small herd size were kept together and in large and medium herd size most of calves were kept separately, that observed during study period. This statement was in contradiction to study by [24] who described that small herd sizes may result in low environmental contamination. Also reported that the highly pathogenic *Eimeria* in cattle occurred more frequently in big farms rather than in small farms [25].

The strong statistically significant difference ($p < 0.05$) of the infection with *Eimeria* in relation to the calf housing of the farms has been demonstrated in this study. Consequently, those calves kept together showed significantly higher prevalence than calves kept at separated. This is most likely due to the fact that almost all of the study calves housed as mixed was overcrowded and in physical contact with each other that favored higher infection rate from a greater chance of licking each other and ingestion of large number of oocysts.

Conclusions and Recommendations

The study revealed that the prevalence of calf *Eimeria* infection in Dairy farms in the study area is 24.4 % (95 % CI, 19.4-30.1). Calves in poor hygienic statuses of the farms, mixed housing of the calf and those diarrhic feces were more affected by *Eimeria* infection. Based on these findings the following recommendations were forwarded: Immune status of the calves could be improved by providing adequate nutrition and good hygiene as well as reducing and monitoring stress levels caused by weaning and overcrowding. Calves should be kept at separated from their dam and peers, Isolation and treatment of sick animals to prevent further disease and premise contamination.

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Conflict of Interests

The authors declare that they have no competing interests.

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