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Prevalence and Associated Risk Factors of Calf Coccidiosis in and around Asela Town, Southeast Ethiopia

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Abstract
A cross sectional study was conducted to determine the prevalence and risk factors associated with clinical coccidiosis in calves from November 2013 up to March 2014 in and around Asela town. Faecal samples from a total of 384 calves with the age of under 1year old were subjected to coprological investigation. Based on the coprological investigation the overall prevalence of coccidiosis was 240 (62.5%). The prevalence of eimerial infection was higher in female calves than male calves (P>0.05). The present study showed that there was significant difference (P<0.05) in the prevalence of coccidiosis among the three husbandry systems of calves with the highest prevalence in semi-intensive system (71.7%). There was significant variation (P<0.05) between calf breeds and infection by eimerias. The highest prevalence of coccidial infection was recorded in calves with poor hygienic condition (80.6%) than in good hygienic status (20.9%) (P<0.05). Seasonal prevalence of coccidiosis showed that there was a significant variation (P<0.05) in eimerial infection of calves and season. The present study has demonstrated that bovine coccidia are one of the most important pathogens in calves in the study area. Value of feeding in troughs, cementing floor of barns in reducing the extent of infection should be communicated to owners. Appropriate monitoring and control of the disease is also advisable in the study farms.
Keywords: Asela, Calves, Coccidiosis, Eimeria, Prevalence, Risk factors

INTRODUCTION

Coccidiosis is protozoan disease of genus *Eimeria* that affects most domestic species. Coccidiosis is a serious disease with adverse effects on general health of various domestic animals. Infection is characterised by acute invasion and destruction of intestinal mucosa, diarrhoea, weight loss, fever, anorexia, emaciation and sometimes death (Coetzer and Justin, 2004).

Bovine coccidiosis occurs worldwide and usually affects cattle under 1 year old, but is occasionally seen in yearlings and even adults, especially if massive infections are acquired (Soulsby, 1986). Of the 13 species recorded, two of the principal pathogens are *Eimeria zuernii* and *E. bovis* (Urquhart et al., 1996). *E. zuernii* and *E. bovis* are usually isolated when clinical cases of bovine coccidiosis (severe diarrhea, dysentery, or tenesmus) occur in heavy infections (Niilo, 1970; Urquhart et al., 1996).

Usually clinical coccidiosis is a result of the interaction of several factors, including age of the animals, the number of ingested oocysts, production systems and management practices, hygienic conditions, stable temperature, season and the level of stress for the animals, which may favour a clinical outbreak of coccidiosis (Lassen et al., 2009; Rehman et al., 2011).

The disease is said to be more severe during dry hot and sunny conditions usually considered unsuitable for oocyst development (Ahmed et al. 1992; Wilber et al., 1994). In the temperate countries, outbreaks of this disease have also been associated with cold seasons and this is attributed to the stress caused to the animals (Maas, 2007). Other stressors such as crowding and weaning also predispose animals to outbreaks of the disease (Rodríguez et al., 1996).

Coccidiosis generally has host species specificity and cross infection between hosts has been documented as impossible (Quigley, 2001). Calves become infected by ingesting sporulated oocysts along with their feed or water. The severity of disease depends upon the number of oocysts they ingest. If few oocysts are ingested, no symptoms will be noticed, but if a large number is ingested, severe disease and even death may occur. However, subclinical infection may cause retardation of growth and add greatly to financial loss. Crowding and lack of sanitation greatly increase the disease hazard. Successive passage of coccidia from one animal to another often builds up infection to a pathogenic level. Long and Millard (1979) showed that animals under nutritional stress are liable to respond adversely to coccidial infection.

The disease causes a lot of economic loss in livestock production industries all over the world (Foreyt et al., 1981). The most serious losses are seen in dairy herds where large numbers of calves are kept. Older cattle are carriers, and they continue to pass oocysts in the faeces (Waggoner et al., 1994 and Holliman, 2000).

Coccidiosis is an important cause of calf morbidity and mortality in Ethiopia, very little is known about this disease (Abebe et al*.,* 2008; Bekele et al., 2012; Alemayehu et al*.,* 2013). No previous study has been carried out in and around Asela town and therefore this study was designed to depict the prevalence of calf coccidiosis and to elucidate the associated risk factors.

MATERIALS AND METHODS

Description of the Study Area

Study Area Asela is located with a latitude and longitude of 7°57`North and 39° 07`East, respectively. It is found at a distance of 175 kilometers to the south east of Addis Ababa. It lies west of Mount Chilalo (with an altitude of 4036m.a.s.l.) on a high plateau overlooking Lake Ziway in the Great Rift Valley of Ethiopia. It is the town found in south central part of Ethiopia in the eastern escarpment of the Great East African Rift Valley in Oromiya national regional state, in Arsi zone, approximately at 2400 meters above sea level. It is surrounded by peasant associations in all directions. The area receives an annual range of rain fall from 700-1658 mm and annual average humidity ranging from 43-60%. The area has a biomodal rainfall occurring from March to April (a short rainy season) and from July to October (long rainy season). The annual temperature range is 10-22.6^{0}C. It has a daily maximum temperature that can reach up to 28^{0}C and minimum temperature of 10^{0}C. Asela town and the surrounding farming community, has a total area of 300.21sq.km. Livestock estimate of the year 2010/11 given by Tiyo woreda Rular and Agricultural Development indicates that the district has 50347 bovines, 16964 equines, 19453 ovines, 6884 caprines, and 22485 poultry.

Study Population

The study was conducted on local and cross-breed calves which are under the age of one year and selected randomly from four PA's in and around Asela town. The age of calves was determined according to Pace and Wakeman (2003) as well as by collecting information from the dairy farm owners.

Study Design and Sample Size Determination

Cross sectional study was used to determine the prevalence of calf coccidiosis and associated risk factors. The Sample size required for the study was determined using the formula given by Thrustfield (2005) and simple random sampling method was implemented in selecting the study calves.

To calculate the sample size, 50% prevalence, 95% Confidence level, 50% expected prevalence and 5 % of desired absolute precision (d=0.05) was used.

$$n = \frac{(1.96)^2 pexp\ (1-pexp)}{d^2} = \frac{(1.96)^2\ 0.5(1-0.5)}{(0.05)^2}$$

$$n = 384$$

Where, n = required sample size, pexp = expected prevalence, d^2= desired absolute precision at 95% Confidence level. According to the above formula 384 calves were sampled.

Sample Collection and Laboratory Investigation

Fresh fecal samples (20gram) were collected directly from rectum or immediately after defecation using sterile disposable plastic gloves and transported to Asela Regional Veterinary Laboratory was kept at 4°C in a refrigerator until processing within 48 hours of arrival. At the time of sampling, the name of the owner, date of sampling and the sex, breed, hygiene and management system was recorded for each calf. Floatation method was adopted for coprological examination as described by Zajac and Conboy (2006).

Assessment of Hygienic Status of Calves

The hygienic status of calf pens were assessed based on housing system (ventilation, draughts, group pens, heavy stocking), sanitation of bedding (soiled bedding) and was categorized as poor, medium and good.

Statistical Analysis

Data collected from study sites were entered into Microsoft excel data base system to be analyzed using SPSS version 16. The prevalence was calculated for all data as the number of infected individuals divided by the number of sampled individual × 100. Pearson's chisquare ($\chi 2$) was used to evaluate the association between the prevalence of coccidiosis and different risk factors. A value of $P<0.05$ was considered as significant.

RESULTS

Overall Prevalence

Out of 384 fecal samples examined, 240 (62.5%) were positive for *Eimeria* oocysts and out of the four PA's surveyed for coccidiosis, virtually all had one or more calves shedding *Eimeria* oocysts.

Prevalence in Sex

The prevalence was a bit higher in female calves than in male ones. However, the sex of the calves was not significantly associated ($P > 0.05$) with infection by coccidiosis (Table 1).

Table 1: Prevalence of Coccidiosis in sex

Breed	No examined	Prevalence (%)	95% CI	df	χ2	P-value
Male	194	119(61.3)	0.541-0.682	1	0.22	0.65
Female	190	121(63.7)	0.564-0.705			
Total	384	240(62.5)				

Prevalence in relation to breed

The present study showed that there was significant variation (P < 0.05) in the prevalence of cross and local breed calves examined during the study (Table 2).

Table 2: Prevalence of Coccidiosis in relation to breed

Breed	No examined	Prevalence (%)	95% CI	df	χ2	P -value
local	142	74(52.1)	0.436-0.606	1	10.373	0.01
Cross	242	166 (68.6)	0.623-0.744			
Total	384	240(62.5)				

Prevalence According to management system

The overall prevalence of husbandry practice was determined and it was 49.6% in extensive, 71.1% in semi-intensive and 57.4% in intensively managed calves. There was statistically significant difference (P<0.05) among the three management systems (Table 3).

Table 3: Prevalence of Coccidiosis according to husbandry

Husbandry	No examined	Prevalence (%)	95%CI	df	χ2	P-value
Extensive	125	62(49.6)	0.405-0.587	2	16.9	0.000
Semi-intensive	205	147(71.7)	0.65-0.778			
Intensive	54	31(57.4)	0.432-0.708			
Total	384	240(62.5)				

Prevalence in Association to Hygiene

There was statistically significant association (P<0.05) between infection with coccidiosis and the hygienic status. Accordingly, calves belonging to poor hygiene showed significantly higher prevalence than calves belonging to the medium and good hygiene in the study area (Table 4).

Table 4: Prevalence of Coccidiosis in association to hygiene

Hygiene	No examined	Prevalence(%)	95%CI	df	χ2	P-value
Good	67	14(20.9)	0.119-0.326	2	68.512	0.000
Medium	183	118(64.5)	0.571-0.714			
Poor	134	108(80.6)	0.729-0.869			
Total	384	240(62.5)				

Prevalence According to Season

In this study, the prevalence of eimerial infection was higher in wet season (67.7%) than that of dry season (57.3%). There was statistically significant difference (P<0.05) between season and infection by coccidiosis among calves (Table 5).

Table 5: Coccidiosis season interaction

Season	No examined	Prevalence(%)	95% CI	df	χ2	P-value
Wet	192	130(67.7)	0.606-0.743	1	4.444	0.035
Dry	192	110(57.3)	0.5-0.644			
Total	384	240(62.5)				

DISCUSSION

The present study revealed that the overall prevalence of calf coccidiosis was 62.5%, which is in line with previous report of Abebe et al. (2008) in Addis Ababa (68.1%) and lower than the finding of Rodriguez-Vivas et al. (1996)

in Debre Zeit (87.8%) but the result was higher than the work of Bekele et al. (2012), (22.7%) in Dire dawa and Alemayehu et al. (2013), (31.9%) in Kombolcha. This variation is most likely attributed to the differences in agro-ecology and husbandry practices of the study animals in different agro ecologies (Radostits et al*.,* 2006).

Analysis of risk factor in the association of disease occurrence has revealed that there was no statistically significant association (P>0.05) between sex (Male 61.3%, Female 63.7%) and coccidial infection. This finding agrees with the report of Alemayehu et al. (2013). This indicates that sex does not have influence on the occurrence of coccidian infection. This is due to either equal chance of accessing the oocytes or no difference on protective immunity for the disease. During investigation, breed (Local 52.1%, Cross 68.6%) of calves was showed statistically significant difference (P<0.05) to coccidiosis. However, the present finding disagrees with previous studies indicating that there was no statistical significant association between breed and coccidian infection (Alemayehu et al., 2013). This is due to either unequal likelihood of being infected with coccidiosis or no difference on protective immunity for the disease. The influence of management system on prevalence of coccidia (Extensive 49.6%, Semi-intensive 71.7% and Intensive 57.4%) has revealed that there was statistically significant association between them (P<0.05). This result also disagrees with the previous report by Alemayehu et al. (2013) indicating that there was no statistical significant association between the occurrence of coccidial infection and management system. This might be attributed to the fact that hygienic system of the barn, nutritional status and contamination of the feed or overcrowding of the animal was different in all management systems. Moreover, management factors may also be related to greater susceptibility of cattle to coccidial infection. Calves that are reared under artificial conditions are exposed to greater numbers of risk factors for eimeriosis, such as: early weaning, failure to ingest colostrum and difficulty in adapting to artificial high-density diets. Pasture with high concentrations of animals also present greater quantities of feces deposited, and consequently, greater contamination of the ground with parasite eggs and oocytes, which constitutes a risk for susceptible calves (Jolley and Bardsley, 2006). It is important to emphasize that, even in the subclinical form the lesions caused by different species of this parasite may be related to lower nutrient absorption, with an effect on the performance, health and production of the animals (Lassen et al*.,* 2009).

The stronger association (P<0.05) of eimerial infection in relation to the hygienic status (Good 20.9%, Medium 64.5% and Poor 80.6%) of calves has been demonstrated in this study. Consequently, calves belonging to poor hygiene showed significantly higher prevalence than calves belonging to medium and good hygiene. This result agrees with the report of Bekele et al. (2012). This could imply that poor sanitation in the calving and calf housing areas as well as poor management of housing favors infection with coccidiosis. Obviously, poor ventilation, droughts, poor calf nutrition, group pens, heavy stocking, cows present with calves, soiled bedding were regarded as risk factors for coccidiosis (Radostits et al*.,* 2007).

There was a strongly significant association (P<0.05) between season (Wet 67.7% and Dry 57.3%) and the risk of infection by coccidiosis in calves. Higher infection rate was observed in wet season than dry season. The present study agrees with the previous reports of Rehman et al. (2011) indicating that in the rainy months, the prevalence of eimeriosis increased. According to Jolley and Bardsley (2006), moderate temperatures favor development of the biological cycle of the parasite. Thus, knowledge of the conditions that favor parasite development is important for establishing control strategies, both in the rainy season and in the dry season, given that infection can even occur during the latter period. This is even more important when it is borne in mind that different species present different pathogenesis (Jolley and Bardsley, 2006), and that their occurrence may vary over the seasons of the year. It has been reported that cold stress and changing weather leave the door wide open for the opportunistic, pound-robbing coccidian protozoa; hence, severe outbreaks of coccidiosis are common shortly after very cold weather (Urquhart et al*.,* 1996; Radostits et al*.,* 2007).

CONCLUSION

The results of the present study showed that maximum infection rate was observed in poor hygienic status of the farms and in semi-intensive management system. This parasite can be responsible for production losses in these ruminant hosts. Therefore very strict hygiene should be made in dairy barns to minimize the exposure of calves to coccidian and Calves with severe diarrhea should always be isolated and treated immediately with appropriate drugs.

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CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

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