SHORT COMMUNICATIONS

Study on prevalence and risk factors of calf coccidiosis in and around Jimma town, Southwest Ethiopia

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ABSTRACT

Coccidiosis is a protozoan disease caused by Eimeria species and seen in animals up to two years old, and is particularly common in calves between three weeks and six months of age. Twelve Eimeria species have been identified in the feces of cattle worldwide from which only three (*E. zuernii, E. bovis,* and *E. auburnensis*) are associated with clinical diseases which is more common during the wet season of the year. A cross-sectional study was conducted from November 2013 to March 2014 to determine the prevalence and assess the risk factors of calf coccidiosis in and around Jimma town. Fecal samples were collected from a total of 384 calves and were examined for the oocysts of *Eimeria* by floatation technique using saturated sodium chloride solution. Age, sex, breed, body condition, and hygienic status of the calves, farming system and medical history were hypothetical risk factors which were assessed. From 384 calves, 119 (31.0% 95% CI: 26.4, 35.6) were positive for *Eimeria* oocysts. There was strong statistical significant difference (P=0.000) in the occurrence of coccidian oocyst shedding between poor and good body conditioned calves. However, the difference in prevalence was not statistically significant between the different age, sex, breed, medical history and hygienic status of the calves. The present study showed that calves' coccidiosis was one of the important disease in the study area and warrants appropriate disease prevention and control measures and further molecular epidemiological investigations to determine the circulating Eimeria species and other pathogen risk factors for good preventive strategy development.

Keywords: coccidiosis, calves, Jimma, prevalence, risk factors.

INTRODUCTION

Bovine coccidiosis is one of the most common parasitic diseases of cattle that prevail widely in different parts of the world. More than twelve different species of *Eimeria* in cattle and buffalo have been documented until now. Most commonly prevalent species are *E. bovis, E. zuernii*, and *E. auburnensis* (Lassen et al., 2009). *E. bovis* and *E. zuernii* are highly pathogenic causing mortality and morbidity by disturbing absorption mechanisms. *Eimeria* is very host specific which limits the infection transmission to come from other cattle and occasional passive transfer of oocysts. The oocysts require sporulation time outside of the animal ranging from a few days to weeks depending on the species, humidity, temperature, and other environmental factors (Daugschies and Najdrowski, 2005). The oocysts are very resistant and can survive minus degrees temperatures for long periods that can span the winter season (Svensson, 1995).

Coccidiosis in cattle commonly occurs as subclinical disease causing great economical losses. In cattle, it is observed in all age groups but it is most common and important in young animals. In associations with other enteropathogens, coccidia have been indicated as an important cause of diarrhea in calves. Negative correlation exists between age of cattle and risk of infection (Abebe et al., 2008). Higher oocyst counts have been observed in immature as compared to adults. A number of risk factors like season, moisture, temperature, sex of animal, watering system, feeding system, housing system influence the prevalence of disease. A higher intensity of infection is found in wet season as compared to dry season. Cattle directly fed on ground or grazing animals have more chances of ingestion of coccidian infection as compared to animals fed in feed troughs as reported by Abebe et al. (2008) from Ethiopia. Female animals are more susceptible to infection. Eimeriosis in cattle is particularly a problem of confined animals and the disease is more common in housed animals than in those on pastures. Fecal contamination of feed and water are important factors for the transmission of the infection. Other factors like poor nutrition, poor sanitation, and overcrowding can increase level of infection and incidence of the disease due to stress-induced immune-suppression (Taylor et al., 2007).

Cattle infected with *Eimeria* acquire some immunity to infection. However, the host reaction seems to be largely dependent on age, species of *Eimeria*, infection dose, and intervals (Daugschies and Najdrowski, 2005). Young calves are especially susceptible due to their undeveloped immune system, and in the farm environment this development may be delayed due to immune-suppressing stress factors, widening the time window for coccidiosis. Calves at the age between 3-6 months seem to be particularly at risk to this disease due to reduced immunity rather than a delay in the age acquired resistance. The animal gets infected with several species during its lifetime. Naturally, acquired infections are usually of mixed species, and of varying doses and intervals. The location in the intestine, antigen structures, and life cycle intervals vary between different *Eimeria* species. As a consequence, the species can potentially infect cattle both simultaneously and consecutively (Sanchez et al., 2008).

The prevalence, species composition, and importance of bovine coccidiosis have been documented in various countries of the world; however, it is excluded from reports on animal morbidity and mortality in Ethiopia. To the authors' knowledge, a single study is available on the coccidia of cattle in Ethiopia is the work of Kassa (Kassa et al., 1987) who reported outbreak of

coccidiosis due to *E. zurnii* and an overall prevalence of 24.9% in a 5-year retrospective laboratory examination in a study conducted in Abay- Tana settlement dairy farm in Bahr Dar. As a result, there is scarcity of information on the occurrence and losses associated with bovine coccidiosis and very little attention has been given to the role of coccidiosis as the cause of disease and production losses in cattle in Ethiopia. Moreover, no attempt was made to determine the prevalence, species composition, and associated risk factors of *Eimeria* infections in cattle in Jimma area. Therefore, taking into account the significance of the parasite as one of the most important causes of economic losses and the scarcity of information in the country, the present study was conducted to determine the prevalence and associated risk factors of calves' coccidiosis in and around Jimma town.

MATERIALS AND METHODS

Study Area:

The study was conducted in and around Jimma town, in Oromia regional State which is located at 352km south west of Addis Ababa at latitude of $7^0$13' and $8^0$56' N and $35^0$52' and $37^0$37'E longitude & an elevation of 1915m.a.s.l. The minimum and maximum annual temperature of the area ranges from 7°C to 30°C while the mean annual rainfall is 1530mm. The livestock population of the Jimma zone are about 2016823 cattle, 942908 sheep, 288411 goats, 74574 horses, 49489 donkey, 28371 mules, 1139735, poultry and 418831 bee hives (JAO, 2008).

Study Population:

The study population was consisting of male and female calves of less than two years of age. Fecal samples of calves of different dairy farms and small holders' farms were collected and examined for coccidian.

Sample Size Determination and Sampling Methods:

The sample size required for this study was determined based on sample size calculation method for simple random sampling of infinite population (Thrusfield, 2007). A 50% conservative expected prevalence, 5% absolute precision and 95% confidence level were considered in the calculation yielding a minimum number of calves required to determine the prevalence as 384. The study area (Jimma town and surrounding farms) was purposively considered based on the population of calves and absence of study on this economically important disease in the area. Individual farms and/small holders and calves were selected randomly.

Study Design:

A cross-sectional study was the design used in the study. The sampled animals were categorized into three age groups as group I = < 6 months age, group II = 6 - 12 months age and group III=12-24 months and the age was determined from animal history record book in intensive dairy farms and by asking the owner (Abebe et al., 2008). The selected animals were also categorized into two according to their body condition as poor and good based on different body visible bone structure and fat deposit according to (Nicolson and Butterworth, 1986)

Sample Collection:

A fresh fecal sample of about 20gm was collected from the rectum of each calf using sterile disposable plastic gloves. Each collected sample was placed in a labeled clean glass bottle container and was transported to JUCAVM veterinary parasitology laboratory on the same day and was kept at 4°C in a refrigerator until processing within 48 hours of arrival (Johannes, 1996). At the time of sampling, the name of the calves' owner, date of sampling, consistency of the feces (soft, pasty, watery, or normal), age, sex, breed, body condition and tag number (if present) were recorded for each calf on a recording format.

Faecal Examination with Simple Floatation Method:

The collected samples were subjected to flotation techniques. Approximately 3gm of faeces was placed in a beaker 1 and 50 ml flotation fluid was poured into the beaker. The faeces and flotation fluid was mixed thoroughly with a stirring device. The resulting faecal solution was poured into beaker 2 through a tea strainer. The faecal suspension was poured into a test tube from beaker 2. The test tube was placed in a test tube rack and it was gently filled with the suspension, leaving a convex meniscus at the top of the tube. A coverslip was carefully placed on the top of the test tube and the test tube was left to stand for 20 minutes after which the cover slip was removed and placed on a microscope slide and examined under microscope (Hendrix, 1998).

Data Collection, Management and Analysis:

For each individual animal examined information relevant to epidemiological investigation were collected and entered and managed on database established in Microsoft Excel spread sheet for Windows 2007. All statistical analysis was carried out using statistical program for Social Sciences version 16 (SPSS INC. Chicago, IL). Descriptive statistics was used to estimate prevalence of the disease across the individual factors. Pearson's chi square was used to assess possible association between the prevalence of coccidiosis and explanatory variables (risk factors). P-value <0.05 was used for statistical significance association.

RESULTS AND DISCUSSION

The cross-sectional study was primarily conducted to assess the prevalence of calf coccidiosis and investigate potential risk factors related to its occurrence. Its overall prevalence was 31% (119/384; 95% CI (26.4, 35.6) (Table 1). This is important information because quantitative assessment of this disease provides good evidence to consider the economic burden assessment of this important disease. Accordingly, the present study revealed that calf coccidiosis is found to be an important livestock disease in and around Jimma town. This overall prevalence of Eimeria oocyst shedding in calves recorded in this study was lower than previous reports (68%) in the central high land of Ethiopia by (Rahmeto, 2005); 67.4% in a neighboring Kenya by (Munyua and Ngotho, 1990); 68% in Turkey by (Arslan and Tuzer, 1998); 82.28% in the coastal plain area of Georgia (USA) by Ernst et al. (1987); 64.2% in Canada by Kennedy and Kralka (1987); and 87.8% in Mexico by (Rodriguez-Vivas et al., 1996). The results of the present study, however, are in line with the report of 33.33% in Southern Bahia, Northeast Brazil by (Almeida et al., 2011). The lower prevalence of coccidiosis recorded in this study as compared to the aforementioned reports 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 our study has been undertaken mainly in dry season. Besides, in the present study area very cold weather is rarely observed and the weather condition is more or less constant. It has been reported that cold stress and changing weather leave the door wide open for the opportunistic coccidia protozoa; hence, severe outbreaks of coccidiosis are common shortly after very cold weather (Johannes, 1996; Radostits et al., 2007).

The body condition of the calves was strongly associated ($P < 0.05$) (Table 1) with risk of infection. Accordingly, calves with poor body condition showed higher prevalence of coccidiosis than calves with good body condition. This is due to the fact that body condition is intimately related to animal's health, quality or vigor and has been widely claimed to be an important determinant of fitness (Peig and Green, 2009). As a

result, coccidia do not stimulate good immune protection in animals with poor body condition.

The prevalence of the disease was 32.8% in male and 29.2% in female calves (Table 1). But, absence of statistically significant difference between this prevalence might suggest that both sexes of the animals at this age have almost equal likelihood of being infected with coccidiosis. Despite this, previous studies done on adult cattle reported higher in female animals than in males (Lassen et al., 2009).The higher prevalence in females 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., 2007).

The highest prevalence (36.4%) was recorded in relatively older calves (greater than 12months) but was 25.2% in the youngest calves (less than 6 months old**)**. There was no statistically significant variation (P > 0.05) in prevalence of coccidiosis between these age categories. However, the prevalence of coccidiosis was appeared to increase with the age of the examined calves. Accordingly, the highest prevalence of coccidiosis was observed in calves between 12-24 months of age. This is due to the fact that almost all of the studied calves older than 12 months were housed in a large numbers in overcrowded condition. These older calves may also be in physical contact with adult animals that favored higher infection rate from a greater chance of licking each other and ingestion of large number of oocysts. This is in agreement with previous reports (Kennedy, 2001; Abebe et al., 2008). The low prevalence of coccidiosis in calves less than 6 months age might be due to passive immunity from colostrums during the first few weeks of life.

Farming system, hygienic status of the farm or calves' barn, medical history (history of recent treatment), and some of the management related risk factors were also assessed in this study. Accordingly, the prevalence of the disease was 30.4%, 37.9% and 30.4% respectively in intensive, semi-intensive and extensive farms. The prevalence of the disease in calves which belong to a farm/house hold with good and poor hygiene was 29.1% and 31.8% respectively. The influence of farming system on prevalence of coccidia has revealed that there was no statistically significant association between them (P>0.05). This might be attributed to the fact that nutritional status and contamination of the feed or overcrowding of the animals was similar in the three farming systems. This finding disagrees with the previous reports by (Kennedy and Kralka 1987; Abisol, 2004).

The prevalence of the disease in calves which are not treated and treated recently was 32.1% and 26.6% respectively. There was no statistically significant association between coccidia infection and medication history of the calves. But, higher prevalence was recorded in calves not treated than treated ones. The absence of significant association might be due to the treatment of calves at the time which the multiplication stage of coccidia was already passed. It is stated by Dedrickson (2002) that medications commonly used for treatment have very little effect on the late stages of the coccidia. The only effective treatment for the already sick animal is supportive therapy (fluids) and antibiotics to avoid secondary infections.

Faecal consistency is one of the factors considered in this study. Calves with diarrheic feacal consistency showed significantly higher (P<0.05) prevalence than calves with soft, normal and constipated feacal consistency (Table 1). This study agrees with the finding of (Pandit, 2009). However, this finding disagrees with the report of (Abebe et al., 2008). Although there was no statistically significant association (P>0.05) between the hygienic status of the calves and prevalence of coccidia infection, a higher prevalence of coccidiosis was observed in calves with poor hygienic status. This could imply that poor sanitation in calf

housing areas favors infection with coccidiosis. This study disagrees with previous studies indicating that there was a statistical significant association between hygienic status of the calves and prevalence of coccidiosis by (Rahmeto, 2005). Analysis of risk factor in the association of disease occurrence has revealed that there was no statistically significant association between breed and coccidia infection. This might be due to either equal chance of accessing the oocysts or no difference on protective immunity for the disease in all breeds. This finding agrees with the report of (Abebe et al., 2008).

Table 1. Univariate association of the hypothesized potential risk factors to calve coccidiosis (n=384) from Jimma, Ethiopia.

Risk factor	No. of calf examined	No. of positive	Prevalence (%)	X^2	P- value
Sex					
Male	192	63	32.8%	0.597	0.440
Female	192	56	29.2%		
Age(months)					
<6	115	29	25.2%		
6-12	118	35	29.7%	3.974	0.137
12-24	151	55	36.4%		
Breed					
local	277	86	31%		
exotic	77	21	27.3%	1.637	0.441
cross	30	12	40%		
Body condition					
poor	202	79	39.3%	13.138	0.000
good	182	40	29%		
Hygiene					
Poor	274	87	31.8%	0.260	0.610
good	110	32	29.1%		
Farming system					
intensive	125	38	30.4%		
Semi-intensive	29	11	37.9%	0.707	0.702
extensive	230	70	30.4%		
Medical history					
Not treated	305	98	32.1%	0.36	0.498
treated	79	21	26.6%		
Faecal consistency					
diarrheic	10	9	90%		
soft	23	11	47.8%	20.621	0.000
normal	336	95	28.3%		
constipated	15	4	3.4%		
Total	384	119	31%		

Results from this study indicate the *Eimeria* infection is high and could potential pose significant economic problems to livestock producer. Poor body condition and diarrheic state of the calves have been found associated with high probability of recovering *Eimeria* oocysts. Maintaining the body condition of calves by providing adequate nutrition and good hygiene as well as reducing other stressors. Further epidemiological investigation in different season of the year should be carried out to look at the effect of season on prevalence of the disease and other stressor factors.

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