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Full Length Research Paper

Prevalence of bovine coccidia in Kombolcha district of South Wollo, Ethiopia

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A cross sectional study was conducted from November 2011 up to April 2012 in Kombolcha town to determine the prevalence of coccidia infection in calves. Fecal samples were collected from a total of 288 calves with the age of 1 month to 1 year old which were included in the study purposively. After collection, the samples were transported to the laboratory and examined for the presence of *Eimeria* oocyst by flotation techniques. For positive sample, a solution of 2.5% potassium dichromate ($K_2Cr_2O_7$) was added to the feces containing the oocyst for sporulation and identification of the species. Out of 288 calves, 92 (31.9%) were found to be positive for *Eimeria* species. There was statistically significant difference (P< 0.05) in the prevalence of coccidia infection to different age of animals or fecal consistency. However, the difference was not statistically significant (P>0.05) between coccidia infection and sex, breed, body condition, address or management system. Five species of *Eimeria* were identified in the study and the most prevalent species were *Eimeria bovis* (42.3%), *Eimeria zuernii* (28.3%) and *Eimeria auburnensis* (13.0%). The other species were *E. ellipsoidalis* (8.7%), *E. alabamensis* (4.3%) and unidentified oocyst (3.3%). In conclusion, the present finding has demonstrated that bovine coccidia are one of the important pathogens in calves in the study area. Further epidemiological investigations are required to determine the *Eimeria* species composition and different agro ecological risk factor on the occurrence of the disease.

Key words: Calves, coccidiosis, *Eimeria*, Kombolcha, prevalence, risk factors.

INTRODUCTION

Coccidiosis is a parasitic disease of the intestinal tract caused by microscopic organisms called coccidia and is 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 the most common and important in calves younger than 1 year. All calves managed under conventional systems are exposed to coccidia and become infected early in life. Many studies indicated that under natural conditions, mixed species infections are much more common than mono species infection (Ernst et al., 1987). Coccidiosis 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 enteropathogens, coccidia has been indicated as an important cause of diarrhea in calves (Radostits et al., 1994).Coccidiosis spreads from one animal to another by contact with infected feces and is one of the most alarming problems for calf rearing industry. The most common clinical manifestations include in appetence, weakness, and loss of weight, diarrhea, depression and anemia (Soulsby, 1982). 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 (Daugschies and Najdrowsk,

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2005).

More than 13 species of *Eimeria* and one species of *Isospora* have been described to infect cattle and causes of coccidiosis. *Eimeria bovis* and *Eimeria zuernii* are considered the most pathogenic species as they are usually associated with clinical coccidiosis under field conditions. Thus, determination of prevalence, species composition, associated risk factors and animal management and husbandry practice is very useful in designing efficient control strategies (Ernst et al., 1984). *E. zuernii, E. bovis* and *Eimeria auburnensis* are the species most often associated with clinical disease in cattle, and other species have been shown to be mildly or moderately pathogenic. Coccidiosis is commonly a disease of young cattle (1 to 2 month to 1 year) and usually is sporadic during the wet seasons of the year (Fraser, 2006).

The prevalence, species composition, and importance of bovine coccidiosis have been documented in various countries of the world. Ernst et al. (1987) reported 82.28% infection rate in the coastal plain area of Georgia (USA); Rodriguez-Vivas et al. (1996) reported 87.8% infection rate in a sub humid tropical climate; Pandit (2009) reported 73.2% infection rate in Kashmir valley. In Ethiopia, Abebe et al. (2008) reported an overall prevalence of 68.1% in cattle in Addis Ababa and Debre Zeit area. However, there is lack 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, especially in Kombolcha district of South Wollo. 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 designed to determine the prevalence, species composition, and associated risk factors with *Eimeria* infections of calves in Kombolcha district.

MATERIALS AND METHODS

Study area

The study was conducted in Kombolcha town, which is found to the North East of Ethiopia in Amhara regional state from November, 2011 to April, 2012. The town is located in a range of altitudes between 1,500 and 1,840 m above sea level with average rainfall of 750 to 900 ml during the study period. Its annual temperature ranges from 25 to 30°C and the relative humidity of the region varies from 23.9 to 79% (NMSA, 2010).

Study animals

The study animals were calves within the age of 1 month to 1 year old. A total of 288 fecal samples were collected and examined for coccidia species from different dairy farms and small holders found in Kombolcha. Examined animals were categorized into two age groups as group I = 1 to 6 months age and group II = >6 to 12 months age which was determined by asking the owner of the animal orally (Abebe et al., 2008). Examined animals were also categorized into three according to their body condition: good, medium and poor. This is based on different body visible bone structure and fat deposit (Nicolson and Butterworth, 1986).

Sampling techniques and sample size determination

Purposive sampling technique was used to select the study animals from the target population. The sample size required for the study was determined according to Thrusfield (2005) as follows. By taking a 95% confidence interval, 20% expected prevalence whenever there is no information on the prevalence of the disease in the area and 5% desired absolute precision, the sample size was calculated as follows:

$$n=1.96^2\times P_{exp}(1- P_{exp})/d^2$$

where n = required sample size; P_{exp} = expected prevalence, d = desired absolute precision.

Therefore, 245 calves within the age of 1 month to 1 year old were required from target population in the study area. But, the sample size was maximized to 288 calves.

Experimental

Fecal sample collection

About 30 g fresh fecal sample was collected from rectum from each calf using sterile disposable plastic gloves. The samples were placed in a labeled clean plastic container (universal bottle) and were transported to the parasitological laboratory of Kombolcha Animal Health and Diagnostic Center on the same day of collection and were preserved at refrigerator until processing within 48 h of arrival. At the time of sampling, the name of the farm (owner), date of sampling, consistency of the feces (soft, watery or normal) and the age, sex, breed, address and management system were recorded for each calf on a data recording format.

Parasitological investigation

A 5 g portion of each of the 288 fecal samples collected from the total of 30 g was weighed out using a balance and put in a 50 ml beaker. 42 ml of water was added, mixed thoroughly and poured into a 100-ml glass beaker through a strainer. The 50-ml glass beaker was rinsed with 8 ml of water and the total fluid was poured into four 15-ml conical tip centrifuge tubes. After centrifugation at 1,500 rpm for 5 min, the supernatant was decanted and a sugar solution (specific gravity 1.25) was added to the sediment, until the tube was about half full. The content of each test tube was thoroughly mixed with a wooden applicator stick. With the aid of a conical flux, 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 400× magnification (Hendrix, 1998).

Sporulation of Eimeria oocysts

A solution of 2.5% potassium dichromate was added to each fecal sample, which contained most of the *Eimeria* oocyst in a beaker, mixed thoroughly with a wooden applicator and poured into a Petri dish. Each Petri dish was left on the bench in the laboratory to allow

sporulation. Thereafter, every 24 h, the culture of oocysts was mixed thoroughly and with the aid of medicine dropper, a drop of the culture was placed on a glass slide, covered with a glass cover slip and examined under the microscope to determine when sporulation occurred. When sporulation of oocysts was completed after 14 days, the Petri dish containing oocysts was covered up and stored in a refrigerator at 5°C until needed. Identification of coccidian species will be based on the morphological features of the sporulated oocysts (size, shape, color, and texture of oocyst wall, presence or absence of micropyle, polar cap) and time of sporulation with the aid of taxonomic keys (Soulsby, 1982; Kennedy and Kralkara, 1987; Sommer, 1998).

Data management and 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 Statistical Package for Social sciences (SPSS) 17.0 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. 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.

RESULTS

Prevalence and analysis of potential risk factors for the occurrence of bovine coccidia

Out of all 288 samples, a total of 92 samples (31.9%) tested positive for *Eimeria* species oocysts as shown in Table 1.

Analysis of the potential risk factor for the occurrence of coccidia has revealed that there were a significant association (P<0.05) with age and fecal consistency of the calves. However, there is no significant association (P>0.05) with breed, sex, body condition, address management system of the calves and coccidia (Table 1).

Percentage and analysis of *Eimeria* spp. with the suspected risk factors

Out of 288 calves whose fecal samples were examined, 92 (31.9%) were found to be positive for 5 species of *Eimeria.* The most prevalent species were *E. bovis*, which occurred in 39 (42.3%), *E. zuernii* in 26 (28.3%), *E. auburnensis* in 12 (13.0%), *Eimeria ellipsoidalis* in 8 (8.7%), *Eimeria alabamensis* in 4 (4.3%) and unidentified oocyst were observed in 3 (3.3%) (Table 2).

Analysis of the potential risk factors and species of *Eimeria* has revealed that there is a significant association (P<0.05) between the occurrence of *E. bovis* with body condition and fecal consistency. In addition, fecal consistency has a significant association (P<0.05) for the occurrence of all *Eimeria* spp. However, there is no significant difference (P>0.05) between sex, breed, age, and address and management system for the occurrence of *Eimeria* spp.

DISCUSSION

The present study has revealed that the presence of bovine coccidia species parasitizing the gastro intestinal tract of calves under the age of one years in Kombolcha district of South Wollo. The overall prevalence of *Eimeria* spp. is 31.9%, which is lower than previous findings reported in Addis Ababa and Debre Zeit by Abebe et al*.* (2008) (68.1%), in the coastal plain area of Georgia (USA) by Ernst et al*.* (1987) (82.28%) and in sub-humid tropical climate by Rodriguez-Vivas et al. (1996) (87.8%). This variation is most likely attributed to the differences in agro-ecology, and husbandry practices of the study animals in different countries (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 breed and coccidia infection. These indicate that body condition does not have influence on the occurrence of coccidia infection. This is due to either equal chance of accessing the oocysts or no difference on protective immunity for the disease. This finding agrees with the report of Abebe et al. (2008). There was no statistically significant association (P>0.05) between sex and coccidia infection. The prevalence in female calves was similar to that of males in this study. This finding agrees with the report of Abebe et al. (2008). There was no statistical significant association (P>0.05) between the address of the animals and coccidian infection. However, the present study disagrees with previous studies indicating that there was a statistical significant association between geographic zone and the occurrence of coccidian infection (Abebe et al*.,* 2008).

There was a strongly significant association (P<0.05) between the age of the calves with the risk of infection in which the prevalence of coccidia appeared to follow an age pattern. Higher infection rate was observed in calves >6 to 12 months of age than calves of 1 to 6 months of age due to the fact that there was good nursing of the colostrum feeding for younger calves. During investigation, almost all the calves older than 6 months were housed in overcrowded condition, less care were given and have easy contact with adult animals. This has given more chance for the animals to lick each other and ingest large number of oocysts, which is in agreement with previous reports (Kennedy, 2001; Abebe et al., 2008; Rodriguez-Vivas et al., 1996; Radostits et al*.,* 2006). Coccidiosis occurs most commonly in young animals with a seasonal incidence when young calves are brought together for weaning or moved into feedlots or fed in small areas for the winter months. The prevalence of infection and the incidence of clinical disease are also age related (Radostits et al*.,* 2006).

There was no a statistical significant association between body condition of the animals and coccidian

Table 1. Prevalence and analysis of potential risk factors for the occurrence of bovine coccidian.

Risk factor	No. of calf examined	No. of positive	Prevalence (%)	χ^2	P- value
Breed					
Local	162	53	32.7	0.105	0.750
Cross	126	39	31.0		
Sex					
Male	103	31	30.1	0.252	0.616
Female	185	61	33.0		
Address					
Urban	137	44	32.1	0.004	0.952
Rural	151	48	31.8		
Age					
1-6 month	112	27	24	5.178	0.023
>6-12month	176	65	36.5		
Body condition					
Good	114	34	29.8		
Medium	106	37	34.9	0.698	0.705
Poor	68	21	30.9		
Faecal consistency					
Normal	176	18	10.2		
Soft	62	36	58.8	102.278	0.00
Diarrheic	50	38	76.0		
Management					
Intensive	109	38	34.9	0.687	0.407
Extensive	179	54	30.2		
Total	288	92	31.9%		

Table 2. Percentage of *Eimeria* spp. distribution in Kombolcha district.

Species of *Eimeria*	Number of positive sample	Prevalence (%)
E. bovis	39	42.4
E. zuernii	26	28.3
E. auburnensis	12	13.0
E. ellipsoidalis	8	8.7
E. alabamensis	4	4.3
Unidentified oocyst	3	3.3
Total	92	100

infection (P>0.05). These indicate that body condition does not have influence on the occurrence of coccidia infection. This is due to either the level of infection, sampled size or most of the affected animals harbor the disease without showing clinical signs (Fraser, 2006). There was statistically significant (P<0.005) difference in prevalence rate between fecal consistency with coccidia infection which agrees with the finding of Pandit (2009). However, this finding disagrees with the report of Abebe et al. (2008). In the present study, 76.0% (38/50) of diarrheic calves (blood stained, watery and fetid diarrhea) were found to be positive for *Eimeria*. However, there

were no apparent clinical signs in most of the animals sampled for the study. The influence of management system on prevalence of coccidia has revealed that there was no statistically significant association between them (P>0.05). This finding disagrees with the previous reports by Abisola (2004) and Kennedy and Kralka (1987). This might be attributed to the fact that hygienic system of the barn, nutritional status, contamination of the feed or overcrowding of the animal was similar in both management systems.

The overall prevalence of *Eimeria* spp. in this study was 31.9% (Table 2) and the most prevalent among the 5 species encountered were *E. bovis* (42.4%), *E. zuernii* (28.3%) and *E. auburnensis* (13.0%). These species are the most frequently reported *Eimeria* spp. in outbreaks of coccidiosis throughout the world (Andrews et al., 2004; Abebe et al*.,* 2008; Ernst et al., 1987; Kasim and Al-Shawa, 1985; Oda and Nishida, 1990). This high prevalence of pathogenic species (*E. bovis* and *E. zuernii*) in infected calves and the greater proportions of subclinical infections could negatively influence animals' productivity and cause economic losses from poor feed efficiency, slow weight gain, weight loss, failure to grow to their full potential, and increased susceptibility to other diseases (Fraser, 2006). Moreover, continuous oocysts shed from subclinical infected calves contaminate the environment or the hair coats and cause severe coccidiosis in highly susceptible new calves that are kept in these areas (Abebe et al*.,* 2008; Radostits et al*.,* 2006).

Conclusion

This study has revealed that the prevalence of calves *Eimeria* infection in Kombolcha district was 31.9% and five *Eimeria* spp. namely *E. bovis, E. zuernii, E. auburnensis, E. ellipsoidalis* and *E. alabamensis* were identified in all *Eimeria* positive fecal samples. The high prevalence of *Eimeria* spp. was considered as one of the important infection in cattle farms in the study area. The prevalence of coccidia has no significant association with address, sex, breed, body condition, management system of animals examined during the study period. However, the disease has a significant association (P<0.05) with age and faecal consistency of the calf. Results from this study indicate the *Eimeria* infection has a great significance for the livestock producer and need a serious control and preventive issue. Therefore, further epidemiological investigation on coccidia species should be needed in the study area.

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