Prevalence and Associated Risk Factors of Calves Coccidiosis in Honkolo Wabe District of East Arsi Zone, Ethiopia

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Abstract: A cross-sectional study was conducted from November 2016 up to April 2017 in Honkolo Wabe district of East Arsi Zone to determine the prevalence and associated risk factors of coccidial infection in calves. Fecal samples were collected from a total of 384 calves between the ages of 2 months to 1 year. Samples were examined for the presence of coccidial oocyst by flotation techniques. Out of the 384 calves examined, 206 (53.6%) were positive for coccidial infection test. Coccidia prevalence varied ($P<0.05$) among location, and hygienic status and age of the calves. Greater infection rate was detected in calves kept under poor (62.9%) as compared to medium (54.1%) and good (19.3%) hygienic status. Calf under the age category of 6-12 months recorded higher (64.3%) infection rate than calf less than 6 months of age (42.2%). There was high infection rate in poor (58.7%) than medium (50.7%) and good (45.5%) body condition calves in magnitude. In conclusion, calf coccidiosis severely affects the productivity of livestock in the area. Hence, appropriate disease prevention and control measures are required to reduce its effect.

Keywords: *Calf, Coccidiosis, Prevalence, Risk factors*

Introduction

Livestock contributes to the commercial production systems in most areas of the world. A survey conducted by Food and Agriculture Organization shows that livestock population in the world grow to about 1.43 billion cattle, 1.87 billion sheep and goats, 0.98 billion pigs, and 19.6 billion chicken (Robinson *et al*., 2014). In Ethiopia, livestock production is practiced in all ecological zones (Tegegne and Crawford, 2000); and the country possesses the largest livestock population in Africa of which cattle number is estimated at 53.99 million that consists 9.77% and 7.64% of animals with less than 6 months, and between 6 months to 1 year of age. In terms of breed, 98.95% of the cattle are local breeds and the remaining are cross-breeds and exotic breeds that accounted for about 0.94% and 0.11%, respectively (CSA, 2013).

Livestock in Ethiopia is a significant contributor to economic and social development both at the household and national level. They account for about 15-17% of the total Gross Domestic Product (GDP), 35-49% of agricultural GDP and directly contribute to the livelihoods of more than 70% of the citizens (CSA, 2011).

There are many diseases that affect the livestock productivity in Ethiopia. Coccidiosis is one of the diseases caused by one or more of the many species of coccidia. It is a serious disease with adverse effects on general health of various domestic animals. Infection is characterized by acute invasion and destruction of intestinal mucosa, diarrhea, weight loss, fever, anorexia, emaciation and sometimes death (Coetzer and Justin, 2004).

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

Coccidiosis generally has host species specific and cross infection between hosts has not been documented (Quigley, 2001). Calves are primarily infected via the fecal-oral route and it takes less oocysts to infect a healthy calf (Fayer *et al*., 2000). Infection can rapidly spread from calf to calf when animals are communally housed and overcrowded or from cow to calf via the udder when they are contaminated with infected calf feces in the lying area of the dams (Nasir *et al*., 2009).

Many epidemiological factors like moisture, temperature, and oxygen tension influence the pattern of the bovine coccidiosis (Pilarczyk *et al.,* 2000). In addition, stress factors like change of diet, harsh environment, poor nutrition and sanitation, and overcrowding can increase the level of infection and incidence of the disease due to stress-induced immune suppression (Ernst *et al.,* 1984).

In Ethiopia, despite diarrhea is an important cause of calf morbidity and mortality, studies done to quantify the magnitude of the problem and to determine the underlying causes are scant and scarce. *Eimeria* was among the most common diarrhea causing protozoan enteropathogen in calves in Ethiopia. Some works have been conducted to determine the prevalence and

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economic significance of *Eimeria* in few areas of the country (Rahmeto *et al*., 2008; Alula *et al*., 2013; Tadele *et al.,* 2014; Mohammed *et al*., 2016). However, there is no information on the status of this protozoan parasite as a cause of diarrhea in calves in Honkolo Wabe district and its surrounding. Therefore, the objectives of the present study were to assess the prevalence of calf coccidiosis in selected areas of Honkolo Wabe district and identify possible risk factors for the occurrences of the disease.

Materials and Methods

Study Areas

The study was conducted from November 2016 to April 2017 in 5 selected rural *kebeles* (RKs) namely, Machitu Laman, Siltana 01, Machitu Goto, Taji Walkite, and Changicha of Honkolo Wabe district of East Arsi Zone, Ethiopia. The district is located East of Wabe River, which separate East Arsi Zone from Bale Zone. The area is located at about 269 km East of Addis Ababa. The area receives an annual rain fall ranging from 1200-2150mm and has a biomodal rainfall occurring from March to April (a short rainy season) and from July to October (long rainy season). It is situated at altitude of 2200 – 3850 meters above sea level with the mean annual minimum and maximum temperature of 18°C and 20°C, respectively. The area is characterized by mixed crop-livestock farming system (HWWADO, 2015).

Study Population

The estimated animal population in the study area was about 87216 cattle, 17994 sheep, 9094 goats, 9360 horses, 9520 donkey, and 39250 chickens (HWWFLO, 2016). The study populations are local and cross breeds that are managed under traditional (free ranging) and semi- intensive Management system. The study was conducted on 384 local and cross-breed calves which are under the age of one year and selected randomly from 5 RKs in Honkolo wabe district. The age of the calves was determined according to Pace and Wakeman (2003) as well as by collecting information from the animal owners.

Study Design and Sampling Strategy

A cross sectional study was employed to estimate the prevalence of calves' coccidiosis in the study area. Selection of the districts was based on its accessibility, nearness to the regional laboratory, and absence of previous prevalence study of coccidiosis in the district. A lottery system was employed to select peasant association. Individual households were selected purposively based on the presence of calves (≤ 12 months of age). Since the prevalence of calf coccidiosis in the district has not been reported, 50% expected prevalence rate, 95% confidence interval and 5% desired absolute precision was used and the sample size was calculated according to Thrusfield (2005) and a total of 384 calves were taken for the study.

Sample Collection and Laboratory Analysis

The procedure for sample collection and laboratory processing was conducted according to Hendrix (1998). Fresh fecal samples (20 grams) were collected directly from rectum or immediately after defecation using sterile disposable plastic gloves and transported to Asella Regional Veterinary Laboratory and were kept at 4°C in a refrigerator until processing within 48 hours of arrival. Each fecal sample was placed in a pre-labeled bottle indicating the age, breed and sex of the calf. The presence of fecal oocysts was determined using the concentration of oocyst by flotation method. The principle allowed the eggs to float to the surface of the solution of higher Specific Gravity (S.G), which concentrates at the top and leaves debris lower down. The higher the specific gravity of the solution, more eggs of various types will float. Three gram of fecal sample was weighed using a top loader balance and placed into a mortar and mixed with saturated salt solution of NaCl. It was thoroughly mixed and strained using sieve into test tube of respective fecal sample number and these were placed in test-tube stands. Each test tube was then filled to the brim with salt solution of sodium chloride. Cover slip was placed on test tube surface and was left to stand for 15 minutes after which they were gently lifted (without brushing against the tubes). They were then placed on microscope slides sideways in one quick movement to avoid bubbles on the glass-slide and viewed under the microscope (Hendrix, 1998).

Data Management and Analysis

The raw data was entered and managed using Microsoft Excel worksheet and summarized with descriptive statistics. Statistical package for social science (SPSS) software version 20 was used and the association between prevalence and risk factor was assessed by using Chi-Square test. A statistically significant association between variables was considered to exist if the P-value is less than 0.05.

Results

The overall prevalence of calf coccidiosis in the study area was 53.6%. The prevalence of coccidiosis was highest in Taji Walkite and the lowest in Machitu Goto (Table 1).

Table 1. Prevalence of calf coccidiosis in the selected study area

Location	№ examined	№ positive	Prevalence
Changicha	69	31	44.9%
Machitu Goto	49	20	40.8%
Machitu Laman	96	44	45.8%
Siltana 01	96	64	66.7%
Taji Walkite	74	47	63.5%
Total	**384**	**206**	**53.6%**

As indicated in the table below, the prevalence of coccidiosis in cross and local breeds were 59.8% and 51.7%, respectively. Among the examined calf, higher infection (64.3%) rate was observed in calf under the age category of 6-12 months than in calf less than 6 months (42.2%). There was also high infection rate in poor (58.7%) as compared to medium (50.7%) and good (45.5%) body condition. Greater infection rate was detected in calves kept under poor hygienic status (62.9%) as compared to medium (54.1%) and good (19.3%) management system. Male calf tended (P<0.062) to acquire high infection rate (59.2%) than females (49.6).

Table 2. Association of risk factors with coccidiosis infection in calves

Risk Factors		№ of animals examined	№ of animals positive	Prevalence (%); 95% CI	χ2 value	P-value
Breed:						
	Local	292	151	51.7; 45.8-57.8	1.8	0.176
	Cross	92	55	59.8; 49.0-69.9		
Age:						
	<6 months	185	78	42.2; 34.9-49.6	18.9	0.002
	6-12 months	199	128	64.3; 57.2-70.9		
Sex:						
	Female	220	109	49.6; 42.8-56.3	3.5	0.062
	Male	164	97	59.2; 51.2-66.7		
Body condition:						
	Poor	179	105	58.7; 51.1-65.9		
	Medium	150	76	50.7; 42.4-58.9	3.8	0.147
	Good	55	25	45.5; 31.9-59.4		
Hygienic status:						
	Poor	205	129	62.9; 55.9-69.6[a]		
	Medium	122	66	54.1; 44.8-63.2[a]	35.6	0.002
	Good	57	11	19.3; 10.0-31.9[b]		
Location:						
	Changicha	69	31	44.9; 32.9-57.4[abc]		
	Machitu Goto	49	20	40.8; 27.0-55.8[b]	17.2	0.002
	Machitu Laman	96	44	45.8; 35.6-56.3[abc]		
	Siltana 01	96	64	66.7; 56.3-75.9[c]		
	Taji Walkite	74	47	63.5; 51.5-74.4[abc]		
Total		**384**	**206**	**53.6 (48.5-58.7)**		

[a,b,c]= % values with different letters in the same column are significantly different ($P < 0.05$); CI= Confidence interval.

Discussion

The present study revealed that the overall prevalence of calf coccidiosis was 53.6%, which is in line with previous report of 49.6% in Poland (Pilarczyk *et al*., 2000), 59% in Japan (Hasbullah *et al*., 1990; Oda and Nishida, 1990) , 51.42% in Ethiopia (Tadele *et al.,* 2014) and 52% in South Africa (Matjila and Penzhorn, 2002) 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 Alula *et al.* (2013; 31.9%) in Kombolcha and Mohammed *et al.* (2016; 31%) in Jimma. This variation is most likely attributed to the differences in agro-ecology and husbandry practices under different agro-ecologies (Radostits *et al.,* 2006).

The high prevalence (P=0.062) of coccidiosis in male than female calf was not consistent with the previous studies of Alula *et al.* (2013). In agreement with the present study, Alula *et al.* (2013) did not find significant difference in coccidiosis among local and cross breed calves indicating that breed does not have influence on the occurrence of coccidia infection. This could be due to either equal chance of accessing the oocysts or no difference in protective immunity for the disease.

The strong significant association between the ages of the calves with the risk of coccidiosis infection observed was in agreement with the findings of the previous studies (Rahmeto *et al*., 2008; Ferid *et al*., 2012; Alula *et al.,* 2013) in Ethiopia. In this study, the age dependent prevalence frequency was highest in calves between 6 and 12 months of age, which is similar to that reported on diarrheic calves in Germany (Gillhuber *et al.,* 2014). The low prevalence frequency in younger calves is an attribute of better immunity due colostrum feeding. We also observed that calves older than 6 months were housed in overcrowded condition, less care, and high contact with adult animals, which could have been exposed them to a heavy infection.

There was no significant association between body condition of the calves and coccidian infection (P>0.05). These indicate that body condition does not have influence on the occurrence of coccidia infection. This may be due to the presence of other infection. This result agrees with the report of Alula et *al.* (2013).

In this study, a stronger association (P<0.05) between the infection and hygienic status of the calves were demonstrated. This result agrees with the report

of Ferid *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. Generally, droughts, poor calf nutrition, group pens, heavy stocking, presence of cows with calves, and soiled bedding were regarded as risk factors for coccidiosis infection (Radostits *et al.,* 2006). The variation in prevalence of infection between locations may be due to differences in management systems.

Conclusion

In the present study, the overall prevalence of calf coccidiosis was 53.6%. Age, location, and hygienic status are the most noticeable risk factors related to coccidial infection. Poor management systems and inefficient use of anticoccidial drugs as preventive measure against the disease might have played a momentous role in the spread of coccidiosis. Therefore, isolation and treatment of sick animals, provision of adequate nutrition and space, and good hygiene are important management tools in order to prevent infection and premise contamination. An additional study is required to determine the protozoan parasite species composition and risk factors under different agro-ecology and management levels.

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Conflict of Interests

The authors declare that they have no competing interests.

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