Original article
PREVALENCE AND ASSOCIATED RISK FACTOR OF BOVINE CALVES COCCIDIOSIS IN NEKEMT CITY, OROMIA, WESTERN ETHIOPIA

Walkite Furgasa, Sosina Dawit, Shibiru Wako and Adisu Dube

Wollega University, school of veterinary Medicine
East wollega Agricultural office, Guto Gida Veterinary Clin

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ABSTRACT

Coccidiosis is a parasitic disease caused by a small, single celled parasite, called a protozoa, that lives inside the cells of an infected animal's intestinal tract and is one of the most common and important disease of calves in the world. A Cross-sectional study was conducted in and around nekemt town from January 2022 up to September 2022 to determine the prevalence and associated risk factors of infection in calves. Faecal samples were collected from a total of 384 calves less than 24 month of age and examined for the oocysts of coccidian. Detailed information of the age, sex, breed, management system and hygienic status were considered as risk factors. Centrifugal faecal floatation technique using sugar solution was used to detect coccidial oocyst. From the total calves included, 176 calves were demonstrated for the presence of coccidial infection. The most of diarrheic calves show a positive result for Eimeria infection. Coccidian oocyst was detected in calves from 1 to 2 year of age but greater prevalence was observed in age categories less than 6 month of age. Statistically significant association (p<0.05) between prevalence of coccidiosis and age, breeds and husbandry system was observed in the study. There was a statistically significant association (P<0.05) between prevalence of coccidiosis and the hygienic status of the calf. Accordingly, calves with poor hygienic condition showed significantly higher prevalence than calves which have relatively better hygienic condition However, there was no statistically significant association (p>0.05) with sex. In conclusion, the study revealed that calf coccidiosis was prevalent in and around nekemete town and consequently affects the productivity of the sector. Hence, appropriate disease prevention and control measures are required to be undertaken to reduce its effect.

1. Introduction

Parasitic diseases are a major constraint in animal health and production throughout the tropic and sub-tropical countries of the world (Bruhn et al., 2011). Parasitic disease caused by helminthes, protozoa and arthropods can cause more economic losses than disease caused by bacteria and viruses but their impact is not clear to animal owners (Jugal and Single, 2011). Bovine coccidiosis occurs worldwide and usually affects cattle under one year old, but it occasionally seen in yearlings and adults. Bovine coccidiosis has been observed in almost all areas where cattle are raised and is usually most common and important in calves younger than one year (Daugschies and Najdrowsk, 2005). 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 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, 2005).

Eimeria infections are one of the most common and important diseases of cattle worldwide. It is a protozoan disease that has a special place among the many parasite species for different reasons caused by various species of Eimeria, widespread distribution regardless of the climatic conditions, results major economic losses in animal husbandry worldwide (Almeida et al., 2011; Nisar-Khan et al., 2013).

About 11 species of Eimeria have been identified and documented to cause disease in cattle (Coetzee and Justin, 2004) and the most common pathogenic species in cattle are E. bovis and E. zuernii (Maas, 2007). The other species have been shown experimentally to be mildly or moderately pathogenic, but they are not considered important pathogens. All calves kept under traditional management systems are exposed and become infected early in life. As coccidiosis spreads from one animal to another by contact with infected feces, it is one of the serious problems for calf rearing industry (Lucas et al., 2006).

Adult animals are usually asymptomatic carriers that often serve as a source of infection for juvenile animals, which are more susceptible to infection. In association with other enteropathogens, coccidia have been indicated as an important...
cause of diarrhea in calves on the first few months of their age (Abebe et al., 2008). They develop only in the intestinal epithelial cells, leading to mucosa damage and the appearance of clinical signs, malnutrition, weakness, anaemia, diarrhoea and haemorrhagic faeces (Yuet et al., 2011).

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 practice (Alula et al., 2013). Diagnosis of coccidiosis depends on the discovery of oocysts on faecal examination using direct smear, flotation or McMaster’s techniques. Studies have demonstrated that the prevalence of Eimeria species in cattle varies between different regions and age of animal (Alemayehu et al., 2013).

The prevalence, species composition, and importance of bovine coccidiosis have been documented in various countries of the world. In Ethiopia, different finding reported that young age and poor hygiene status of the farms were strongly associated with infection of coccidiosis in dairy farms. However, in another study by Alula agreed that age was a significant factor but breed, body condition, sex, and management system were not significantly associated with the disease (Dawid et al., 2012).

According to Dawid et al 2012), although coccidiosis is an important cause of calf morbidity and mortality in Ethiopia and very little attention has been given to this disease. Nekemte is one of the cities of Oromia where urban and periurban dairy farms dwell to provide milk for population of the city. Reports on coccidiosis are scarce to assess the magnitude of this disease and no original information available regarding the prevalence of Coccidiosis affecting calves in the study area. Therefore the objectives of the present study were: To estimate the prevalence of coccidiosis affecting calves in Nekemte city and to estimate the associated risk factors of coccidiosis in dairy calves

**MATERIALS AND METHODS**

**Study Area**

The study was conducted in Nekemte town, East Wollega zone, Oromia regional state, Western Ethiopia from January 2022 up to September 2022. Nekemte lies at altitude of 900° 5' N and longitude of 36° 33' E with an elevation of 1,960 to 2,170 meters above sea level. Distance of the district is 331 km from Addis Ababa. The climatic condition alternates with long summer rainfall (June to September), short rain season (March to April) and winter dry season (December to February). The maximum and minimum annual rainfall and daily temperature range are between 2,200 to 1,500 mm and 15°C to 27° C respectively. This area is characterized by mixed farming system, which is engaged in agricultural and livestock production. The calves population of the town is 4812 cattle, 851 sheep, 359 goats, 81 horses, 21 mule, 851 donkeys and 4850 chickens. The majority of the people of the town belong to the Oromo ethnic community and Afan Oromo (the Oromo language) is the widely spoken language in the area (EWAO, 2013).

**Study Population**

The study was conducted on calves younger than 24 months by dividing in to three groups: Birth up to 6 months, 6-12 months and 12-24 months which were determined by asking the owner of the animal orally (Mihreteab et al., 2012). This range of age was selected because the disease is more common in young animal. Epidemiological information with respect to their age, sex, breed, management system, and date of sample collection, hygienic states and kebele or name of the farm was collected. Simple random sampling was used to select the study animals from farms and from small holder. Hygienic status of calf pens and the calves themselves were assessed based on housing system (ventilation, stocking and sanitation) and body parts of the calves and was conveniently categorized as poor, medium and good (Mihreteab et al., 2012).

**Study Design**

A Cross-sectional study was conducted in and around Nekemte town from November 2021 to March 2022 to determine the prevalence and associated risk factors of Coccidiosis in calves. Active data was generated from randomly selected calves with regard to age, breed, sex, Husbandry system, and hygienic states were considered as risk factors to test for occurrence of coccidiosis.

**Sample Size Determination**

Simple random sampling method was used to select the calves from target population. Since there was no similar work done in the area previously, expected prevalence was taken as 50% and the confidence interval chosen as 95% and precision 5%. By substituting these values in the formula, the sample size founded to be 384. Thus, the sample size is calculated according to (Thrusfield, 2007) as follows:

\[ n = \left(1.96\right)^2 \times \frac{P_{exp} \times (1-P_{exp})}{d^2} \]

Where, \( n \)= required sample size, \( d \)= absolute precision (usually 0.05) \( P_{exp} \)= expected prevalence

**Data Collection**

A total of 384 faecal samples were collected during the entire period of the study. About 1-20 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 labeled and transported to Veterinary parasitology laboratory, School of Veterinary Medicine, Wollega 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, age, sex, breed, fecal consistency and hygienic status of farm was recorded for each calf on a recording format.

A 3g portion of each of the 384 fecal samples collected was weighed out using a balance and put in a mortar. After grinding with pistil 40ml of sugar solution 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 1200 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 (Hendrix, 1998).

![Figure : Map of the study Area](Source: Arc Map GIS 10.4)
Data Management and Analysis

Data collected from study sites were coded and entered into a Microsoft excel spreadsheet program for analysis. Statistical analysis was done on Statistical Package for Social Sciences (SPSS) software version 16. Descriptive statistics like percentage was used to express prevalence while chi-square ($\chi^2$) test was used to compare the association of coccidiosis with different risk factors. In all the cases, 95% confidence level and 0.05 absolute precision errors were considered. A p-value ≤ 0.05 was considered statistically significant.

RESULT

Out of 384 faecal samples examined, 176 were positive for Eimeria oocysts with the overall prevalence of 36.4%. Even if coccidian oocyst was detected on all age groups the highest prevalence was recorded in those calves found in the range from one to sixth month of age. There was a statistically significant difference (P<0.05) in the prevalence of coccidiosis among the various age group (Table 1). The prevalence of coccidiosis was a bit higher in cross breed calves than in local breed calves. However, the breed of the calves was significantly associated (P < 0.05) with prevalence of coccidiosis. There was no statistically significant association (P>0.05) between sex and coccidian infection.

<table>
<thead>
<tr>
<th>Age</th>
<th>Prevalence (%)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 Month</td>
<td>48.4%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>&gt;6-12 Month</td>
<td>46.4%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>&gt;12-24 Month</td>
<td>41.5%</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Table : Prevalence of coccidiosis in calves in relation to host factors

Table : Prevalence of coccidiosis in calves in relation to consistency of feces

There was a statistically significant association (P<0.05) between prevalence of coccidiosis and the fecal consistency of the calf. Accordingly, calves with poor hygienic condition showed significantly higher prevalence than calves which have relatively better hygienic condition (Table 3). Coccidian infections according to management system have significant difference with Intensive, semi-Intensive, and extensive husbandry systems with higher prevalence on intensive system than other systems and the lowest prevalence was observed on calves belongs to semi-intensive system.

DISCUSSION

The overall prevalence of coccidiosis in and around Nekemte based on coprological examination was 36.4% and this current study was in line with the prevalence study of calf coccidiosis in kombokcha which is 32% (Alemayew et al., 2013). However, the prevalence was lower than the previous findings reported in Addis Ababa and bishoftu by (Abebe et al., 2008) (68.1%), in Pakistan by (Muhammad et al., 2010) (47.09%), 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, management types and husbandry practices of the study animals in different areas (Radostits et al., 2006).

The study has revealed that the prevalence of Eimeria has significant association with breed of calves. There was statistically significant association (P<0.05) between breed and coccidia infection. Higher prevalence of the disease condition was observed in exotic breed when compared to local and cross breed. This might be in relation to genetic factors as exotic breed are more susceptible to a disease. This finding agrees with the report of (Abebe et al., 2008) and (Alemayew et al., 2013). There was also 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) and (Alemayew et al., 2013).

Age of the calves was significantly associated (P<0.05) with the risk of infection by coccidiosis and the highest prevalence was recorded in those calves with youngest age groups (1 to 6 months). This is in contrast to (Abebe et al., 2008) who reported that risk of infection by Eimeria species appeared to increase with the age of the examined calves. However, this observation in the current study was in line with (Dennis et al., 2012), (Perfield, 2010) and (Mihreteab et al., 2012), who noted that young animals less than 6 months were
more susceptible than adults. Stress factors like weaning and change of diet can increase the level of infection and incidence of the disease due to stress-induced immune suppression (Kaufman, 1996; Radostitis et al., 2007). In addition to this, coccidiosis is a self-limiting disease in adult and spontaneous recovery without specific treatment is common when the multiplication stage of the coccidian has passed (Radostitis et al., 2007). Based on this, previous exposure might have a contribution to the development of certain level of immunity of older calves as compared to younger that did not experience previous exposure (Faber et al., 2010). The influence of husbandry system from this study also shows that a significant association between prevalence of coccidian infection and different husbandry system which is agree with (Kennedy and Kralka 1987), but strongly disagrees with the work of Alemayew in Kombolcha on prevalence of bovine coccidiosis (Alemayew et al., 2013). Coccidiosis is mostly a disease of young animals kept under intensive management systems when there is stress, overcrowding, housing under conditions of poor hygiene, food changes, nutritional deficiencies, and adverse weather conditions which are favorable for the survival of oocysts and therefore higher infection rates when compared to extensive farming systems (Vorster and Mapham, 2012).

The strong association of the infection with coccidiosis in relation to the hygienic status of calf has been demonstrated in this study. This observation agrees with (Mihreteab et al., 2012). Calves with poor hygiene showed significantly higher prevalence than calves which have relatively better hygiene. This could imply that poor sanitation in calf housing areas as well as poor management of housing favors infection with coccidiosis. Obviously, poor ventilation, heavy stocking, cows present with calves, and soiled bedding were regarded as risk factors for coccidiosis (Daugschies and Najdrowski 2005; Radostitis et al., 2007; Vorster and Mapham, 2012).

Positive correlation between fecal consistency and the occurrence of diarrhea was detected in the present study. During investigation, most of diarrheic calves show a positive result for Eimeria infection. These agree with (Pandit, 2009). The results of the present study confirmed the importance of coccidiosis among the causes of calf diarrhea in the study area.

CONCLUSION AND RECOMMENDATION

This study has revealed that the prevalence of calves coccidiosis in and around nekemte town was 36.4%, which can be taken as high rate of infection. The prevalence of coccidiosis has no significant association with sex and body condition of animals examined during the study period. However, the disease has a significant association (P<0.05) with breed, age, Husbandry system and hygienic status. Breed, age, husbandry system and hygienic status of calves were the major risk factors for the prevalence of coccidiosis in this area. In conclusion, the study revealed that calf coccidiosis was prevalent in and around nekemte town and consequently affects the productivity of the sector. In line with the above conclusion the following recommendation are forwarded: Calves should get colostrum in the first 24 hrs of their life to ensure their immune status, Sanitary prophylaxis should be maintained, Stressful conditions which triggers the disease occurrences should be avoided, Coccidiosis should be used in ration early for prevention and Awareness creation for Livestock producers for the improvement of hygienic status of calf

Ethics Approval and Consent to Participate

The current study was conducted under permitted ethical approval and a statement given by the Research Review Committee of Wallaga University on November 9, 2021 (Minutes No. 12/2021).

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Author Contributions

Authors made a significant contribution during this Msc thesis work from its beginning to end.

References