1. INTRODUCTION

Parasitic diseases are a major constraint in animal health and production throughout the tropic and sub tropical countries of the world [1]. Bovine coccidiosis is caused by different species of Apicomplexan parasite from the genus Eimeria [2]. Coccidiosis is responsible for major economic losses in animal husbandry worldwide [3]. Adult animals are usually asymptomatic carriers that often serve as a source of infection for juvenile animals which are more susceptible to infection [4]. Coccidiosis is commonly a self limiting disease; and the most signs of bovine coccidiosis is chronic or subclinical [5].

The clinical picture of coccidiosis depends on the innate pathogenicity of different Eimeria species. Twelve Eimeria spp have been identified in cattle, worldwide. E. zurnii and E. bovis are known to be highly pathogenic, causing morbidity and even mortality associated with diarrhea, mucus and blood stains.

Abstract: Cross-sectional study was conducted from November 2018 up to February 2019 to determine the Prevalence and to assess the risk factors of calf coccidiosis in Janamora Wereda. Faecal samples were collected from a total of 384 calves with less than 24 months of age and examined for the oocysts of coccidia. Detailed information of the age, sex, breed, management system, hygienic status and faecal consistency were taken in consideration. Centrifugal faecal floatation technique using salt solution was used to detect coccidial oocysts. The current study has revealed that Out of all 384 samples a total of 104 samples (27.1%) were positive for coccidiosis. Coccidial oocysts were detected in calves from birth up to 2 years of age but greater prevalence was observed in age categories less than 6 months of age. Statistically significant association (p<0.05) between prevalence of coccidiosis and age, breed faecal consistency, hygienic status and management system was observed in this study. With regard to sex, the prevalence in female calves (29.3%) was a bit higher than males (23.9%). However, the difference was not statistically significant (P>0.05) between the sexes. Sex of calves was not found as risk factor influencing the prevalence of coccidiosis.This study shows that coccidiosis was prevalent in Janamora Wereda which signifies coccidian infection has a great significance for the livestock producer. So, it needs awareness creation, a serious treatment, control and preventive programs.

Keywords: Janamora, Floatation, Coccidiosis, Oocyst & Prevalence.
The other species have been shown experimentally to be mildly or moderately pathogenic, but are not considered important pathogens [6]. Coccidian parasites are generally host-specific parasites, and very specific to a particular region in the intestines [7]. Many studies indicated that under natural conditions, mixed species infections are much more common than mono species infection. Coccidiosis occur most commonly in animals housed or confined in small areas contaminated with oocysts [8] and is usually most common and important in calves younger than 1 year [4].

Clinical disease is most prevalent where animals are subjected to overcrowding, unhygienic environments, or when animals are stressed. Economic loss in clinical disease is mostly attributed to mortality, poor performance, and the costs of treatment and prevention and although subclinically infected animals may appear normal, they may have reduced feed consumption, feed conversion and growth performance[9]. Climatic factors, age of the host, as well as management determine the pattern of presentation of coccidiosis in different regions [10].

In Ethiopia a few studies are conducted in calves by [4, 11] and also in poultry by [12] and other which show the presence of coccidiosis in the country. But no study has been carried in Janamora Wereda to determine the presence of the disease in the area. In general, adequate data on the distribution of calf coccidiosis is lacking.

Therefore the objectives of the study are:

a. To estimate the prevalence of coccidiosis in calves
b. To identify risk factors associated with coccidiosis infection.

2. MATERIALS AND METHODS

2.1. Study area

The study was conducted in Janamora Wereda Janamora Wereda is located in North Gondar Zone of Amhara region, at the latitude and longitude of 12°59’N 38°07’E at a distance of about 180km from Gondar town. Janamora Wereda is well-known with Semien mountain National Park, Ras Dashen i.e the highest point in Ethiopia and it is a home to a number of endangered species including the Ethiopian Wolf, walia ibex, and a wild goat which no found in elsewhere in the world. The area has an altitude range of 2900 meters above sea level. The region is marked by numerous mountains, hilly, and sloppy areas, plateaus, rivers, and many streams. Livestock population of the area comprises 100,386 cattle, 32,975 sheep, 131,041 goats, 2,540 horses, 634 mules, 7758 donkeys, 119,347 poultry. The farming system of the study area is characterized by a mixed crop-livestock production system. Transhumance, from the highlands to western lowlands, is practiced as an important strategy to secure grazing resources for the highland livestock during the dry season of the year. In the case of the lowlands, crop farming is not as intensive as high and mid-highland areas and livestock has larger contributions to the farmer’s livelihoods [12].

2.2. Study animals

The study was conducted on calves younger than 24 months age 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 [13]. This range of age was selected because the disease is more common in young animal. Epidemiological information with respect to their age, sex, breed, faecal consistency (normal, soft and diarrheic), management system, and date of sample collection, hygienic states (house and animal) 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 and good [13].

2.3. 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, [14] as follows:

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

Where;  
- \( n \): required sample size  
- \( P_{exp} \): expected prevalence  
- \( d \): desired absolute precision [9].

2.4. Data collection

A total of 384 faecal samples was collected during the entire period of the study, directly from the rectum of selected calves using a gloved hand and placed into air tight sample vials and transported to Gondar University veterinary parasitology laboratory. Then the sample preserved at refrigeration temperature until processing within 48 hours. During sampling, data with regard to age, sex, breed, faecal consistency, and management system, date of sample collection, hygienic states (house and animal) and kebele or name of the farm was recorded for each sampled animal. Faecal sample was qualitatively examined by centrifugation flotation technique. Salt solution was used as a flotation fluid for examination of oocyst under microscope.

2.5. Study design

A cross-sectional study was conducted from November 2018 to February 2019 in Janamora Wereda. Active data was generated from randomly selected calves with regard to age, breed, sex faecal consistency, management system, and hygienic states (house and animal) was considered as risk factors to test for occurrence of coccidiosis.

2.6. Data management and analysis

Data collected from study sites were coded and entered in to a Microsoft excel spread sheet 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.

3. RESULT

The current study has revealed that out of all the 384 animals examined 104 (27.1%) have tested positive for Eimeria species oocysts as shown in Table 1.

3.1. Prevalence of coccidiosis in calves in relation to host factors

Analysis of the potential host related risk factors for the occurrence of coccidiosis has revealed that there were significant associations (\(P<0.05\)) with age, fecal consistency and breed of the calves. Even though coccidian oocysts were detected on all age groups of calves, all fecal consistency categories and in both local and cross bred calves, the highest prevalence was recorded in those calves found in the range from one to sixth month of age(51.5%), in calves with diarrheic faecal consistency(71.2%) and in cross breed calves (36.2%). The lowest prevalence was observed in the age group 12-24 months, in normal faecal consistency, and in local breed calves. With regards to sex, the prevalence in female calves (29.3%) was a bit higher than males (23.9%). However, the difference was not statistically significant (\(P>0.05\)) between the sexes (Table 1).
Table 1. Prevalence of coccidiosis in calves in relation to host factors

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Number of calves examined</th>
<th>Number of positive cases</th>
<th>Prevalence (%)</th>
<th>Df</th>
<th>X²</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>229</td>
<td>67</td>
<td>29.3</td>
<td>1</td>
<td>1.358</td>
<td>0.244</td>
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<tr>
<td>Male</td>
<td>155</td>
<td>37</td>
<td>23.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>104</td>
<td>27.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6 Months</td>
<td>171</td>
<td>88</td>
<td>51.5</td>
<td>2</td>
<td>92.778</td>
<td>0.000</td>
</tr>
<tr>
<td>[6-12] Months</td>
<td>118</td>
<td>9</td>
<td>7.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[12-24] Month</td>
<td>95</td>
<td>7</td>
<td>7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>104</td>
<td>27.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breed</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Local</td>
<td>294</td>
<td>70</td>
<td>24.1</td>
<td>1</td>
<td>5.204</td>
<td>0.023</td>
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<tr>
<td>Cross</td>
<td>94</td>
<td>34</td>
<td>36.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>104</td>
<td>27.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fecal consistency</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Normal</td>
<td>247</td>
<td>24</td>
<td>9.7</td>
<td>2</td>
<td>1.1432</td>
<td>0.000</td>
</tr>
<tr>
<td>Soft</td>
<td>78</td>
<td>38</td>
<td>48.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrheic</td>
<td>59</td>
<td>42</td>
<td>71.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>104</td>
<td>27.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Df = Degree of freedom, χ²=Pearson’s Chi-square

3.2. Prevalence of coccidiosis in calves in relation to hygienic status and management system

The assessment of hygiene of the calves and management conditions in which they are kept has revealed that there was a statistically significant association (P<0.05) between prevalence of coccidiosis and the hygienic status of the calves. Accordingly, calves with poor hygienic condition showed significantly higher prevalence than calves which have relatively better hygienic condition.

There was also a statistically significant association (P<0.05) between prevalence of coccidiosis and the management system. There was higher prevalence of coccidiosis on calves under intensive management system than those calves on semi intensive and extensive systems. The lowest prevalence was observed on calves belonging to the extensive management system (Table 2).

Table 2. Prevalence of coccidiosis in calves in relation to hygienic status and management system

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Number of calves examined</th>
<th>Number of positive case</th>
<th>Prevalence (%)</th>
<th>Df</th>
<th>X²</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hygienic status</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>283</td>
<td>47</td>
<td>16.6</td>
<td>1</td>
<td>59.789</td>
<td>0.000</td>
</tr>
<tr>
<td>Poor</td>
<td>101</td>
<td>57</td>
<td>56.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>104</td>
<td>27.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extensive</td>
<td>191</td>
<td>31</td>
<td>16.2</td>
<td>2</td>
<td>29.091</td>
<td>0.000</td>
</tr>
<tr>
<td>Semi-intensive</td>
<td>123</td>
<td>39</td>
<td>31.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensive</td>
<td>70</td>
<td>34</td>
<td>48.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>104</td>
<td>27.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Df=Degree of freedom, χ²=Chi-square
4. DISCUSSION

Coccidiosis is a common problem in cattle worldwide [15]. Studies elsewhere have shown prevalences rates ranging between 8% to 100% [16]. Accordingly, research performed across different countries including Ethiopia has revealed varying prevalence rates of Eimeria spp. In Ethiopia, different researchers have reported varying reports; 22.7% Abebe [4], 31.9% Alemayehu [11], 68% Dawid [17]. The same varying scenarios has been documented elsewhere; 22.6% Almeida [2], and 33.3% Poscoti-Bruhn [18], both in Brazil; 47.09% in Pakistan by Muhammad 82.28% [19] in the coastal plain area of Georgia (USA) by Ernst [20] and 87.8% in the sub-humid tropical climate of Yucatan state in Mexico Rodriguez-Vivas [10].

In this study the overall prevalence of coccidiosis based on coprological examination was 27.1% and this study was in line with other reports like the prevalence study of bovine coccidiosis in Kombolcha which is 31.9% Alemayehu [13] 22.6% and 33.3% in Brazil Almeida [2], Poscoti Bruhn [19] and 22.7% % in Ethiopia Abebe [4]. However, the current infection rate (27.1%) was lower than that reported in other investigations; in Addis Ababa and Debre Zeit by Abebe [19] (68.1%), in Pakistan by Muhammad [19] (47.09%), in the coastal plain area of Georgia (USA) by Ernst [20] (82.28%) and in the sub-humid tropical climate Yucatan state of Mexico by Rodriguez-Vivas [18] (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 [8]. In addition, those reports with higher prevalence are from areas where intensive management system is practiced more, and it is known that intensive management has more close contact and favours easy faecal-oral contamination from infected to non-infected calves, especially in farms with poor hygienic conditions. 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.

Furthermore factors like poor sanitation, and overcrowding can increase level of infection and incidence of the disease due to stress-induced immune suppression [4].

There is also differences in number of ingested oocysts, the presence of a concurrent microbial infection, and the functional level of protective immunity may be decisive in whether clinical disease occurs or not [21].

In this observation sex of the calves was not significantly associated (P>0.05) with the risk of infection by coccidiosis. Absence of statistically significant difference between the sexes of the study animals might suggest equal likelihood of being infected with coccidiosis. 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 [4] and Alemayehu [11]. Yet, a bit higher prevalence in male calves could be due to the less care given to the male calves as compared to the female calves that are deemed to be future cows. Despite this, previous studies done on adult cattle reported higher prevalence of Eimeria in female animals than in males [22].

Nevertheless, this could be attributed to the physiological stress loaded on female animals in relation to pregnancies and giving birth as compared to males [23].

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 6months), this observation in the current study was in line with [24, 13] who noted that young animal less than 6 months were more susceptible than adults. This is due to stress factors like weaning and change of diet can increase level of infection and incidence of the disease due to stress-induced immune suppression [8]. 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 [8]. 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.

While the presence of immature immune system increases the susceptibility of younger calves [25, 26]. The results of this study is in contrast to Abebe [4], who reported that risk of infection by Eimeria species appeared to increase with the age of the examined calves. The investigators have explained that
there was good nursing of the colostrum feeding for younger calves which protected the younger from being infected.

There was statistically significant association (P<0.05) between breed and rate of coccidia infection. The highest prevalence was recorded in those calves with cross breed groups than local breed. This is due to either the chance of accessing more oocysts or difference on protective immunity for the disease. This finding disagrees with the report of Abebe [4] and Alemayehu [11].

There was statistically significant (P<0.05) difference in prevalence rate of coccidian infection and faecal consistency which agrees with the finding of Mihreteab [12]. There was higher prevalence of the disease in diarrhoea faecal consistency than normal faecal consistency. This is due to the major damage in the intestinal wall, and the subsequent rupture of the cells of the intestinal lining and the intestine is unable to absorb nutrient and fluid as a result it released in the form of diarrhoea.

However, this finding disagrees with the report of Abebe [4]. This might be due to the cause of diarrhoea is another GIT parasite or other infectious agents like bacteria and viruses rather than coccidian in their investigation.

The influence of management system from this study also shows the presence of significant association between prevalence of coccidian infection and different management system which is in agreement with Kennedy and Kralka [27] but disagrees with the work of Alemayehu who studied on the prevalence of bovine coccidiosis in Kombolcha. Based on their finding, absence of significant difference between intensive and extensive farming systems might be due to presence of good management system in selected animals which belong to intensive management system in Kombolcha Alemayehu [12]. 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 favourable for the survival of oocysts and therefore higher infection rates when compared to extensive farming systems Vorster and Mapham [9]. In this study high prevalence of the disease was observed in intensive management system which is in line with Vorster and Mapham [9]. In this study, the prevalence was low in extensive management system compared to other management system. This might be due to less chance of getting the oocyst in relation to the area they are grazing as there is large grazing roaming area available in extensive management system as compared to intensive management system. In addition there is relatively less degree of stressful condition (in relation to overcrowding and ventilation) as compared to intensive system where overcrowding and confinement can result in stress induced immune suppression. On other hand, continuous exposure to low numbers of oocysts which is often the case under field conditions results in endemic stability Daugschies and Najdrowski [28] which makes them relatively resistant than housed animals.

The strong association of the infection with coccidiosis in relation to the hygienic status of calve has been demonstrated in this study. This observation agrees with Mihreteab [12]. Calves with poor hygiene showed significantly higher prevalence than calves which have relatively better hygiene.

This could imply that poor sanitation in calve housing areas as well as poor management of housing favours infection with coccidiosis. Obviously, poor ventilation, heavy stocking, cows present with calves, and soiled bedding were regarded as risk factors for coccidiosis [28, 9, 8].

5. CONCLUSION AND RECOMMENDATIONS

This study has revealed that the prevalence of calves Eimeria infection in Janamora Wereda was 27.1%. The prevalence of coccidiosis has no significant association with sex of animals examined during the study period. However, the disease has a significant association (P<0.05) with age, breed management system, hygienic status and faecal consistency. This means age, breed management system, hygienic status and faecal consistency of calves were the major risk factors for the prevalence of coccidiosis in Janamora Wereda. 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 and the lowest prevalence was observed in the age group >12-24 month of age. In this study high prevalence of the disease was observed in cross breed than local breed. Calves with poor hygiene are more susceptible than calves which have relatively
better hygiene. Calves with diarrheic faecal consistency are more likely to be affected by coccidiosis than calves which have soft and normal faecal consistency. The lowest prevalence was recorded on calves with normal faecal consistency. In this study high prevalence of the eimeria infection was observed in intensive management system. In general, Eimeria infection causes production and economic loss as well as stress on the animal. It has a great significance for the livestock producer in Janamora Wereda and it needs a serious control and prevention programs.

Based on the above conclusion, the following recommendations are forwarded:

a. Calves should get colostrum in the first 24 hrs of their life to ensure their immune status in general to prevent the occurrence of concurrent infection that predispose to coccidiosis.

b. Stressful conditions like overcrowding and transportation which triggers the disease occurrences should be avoided.

c. There should be isolation and treatment of sick animals to prevent further transmission of the disease.

d. All measures that minimize the amount of fecal contamination of hair coats should be practiced regularly.

e. Feed and water troughs should be high enough to avoid heavy fecal contamination.

f. There should be creation of awareness for live stock producer about the hygiene of the environment.

6. REFERENCES


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