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Research Article

# Prevalence of Cattle Coccidiosis and Associated Risk Factors in Jimma Town and Surrounding Districts

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## Abstract

Cross-sectional study was conducted from August, 2021 up to January, 2022 to determine the prevalence of cattle Coccidiosis and associated risk factors in Jimma Town and Surrounding Districts. Households were selected randomly and data on body condition, age, and sex were recorded and then, a total of 512 faecal samples were collected directly from rectum of randomly selected cattle from Jimma town, Sekka chekorsa, Dedo, and Nadhi-Gibe districts of Jimma zone by considering animal and non-animal factors. To detect the presence of coccidian oocyst simple floatation technique was used. A total of 153 animals were found positive for coccidia infection with overall prevalence of 29.9% with significant difference (p=0.000) between age groups, which was higher in calve (less than 12 month age) than younger animals. Among the epidemiological factors age was found to be statistically significant in explaining coccidia infection in cattle. Place of origin, sex and body condition were relatively significant but they were not statistically significant in associated with infection at p=0.05. Coccidiosis in these four areas presents in the subclinical form and thus no characteristic/overt clinical signs.Almost similar distribution of coccidia infection in these area indicated that common watering points pose a risk as disease foci and therefore farmers should be advised to water their animals from the homesteads or use clean water for their animals.

**Keywords:** Cattles; Risk Factors; Coccidiosis; Jimma; Prevalence

## Introduction

The term "coccidiosis" refers to the disease condition caused by an infection with one or more of the numerous species of parasitic protozoans known as "coccidian. There are numerous types and levels of coccidiosis because each coccidia species results in a unique host-parasite interaction. Only severely infected animals or animals with decreased resistance to infection develop the disease. It is not always the case that an infection will result in the development of clinical symptoms of a disease. Low-level challenge can be advantageous since it prompts the host's immune system to produce defenses [19]. The disease affects almost every type of vertebrate, including birds, cattle, pigs, sheep, goats, cats, and dogs [16].

Cattle coccidiosis is caused by a member of the genus Eimeria, family Eimeridae. There are about 11 species of *Eimeria* have been identified and documented to cause disease in cattle: *E. bovis, E. zuernii, E. auburnensis, E. ellipsoidalis, E. canadensis, E. alabamensis, E. subpherica, E. bukidnonensis, E. wyomingensis, E. cylindrica, E. pellita and E. subsphaerica* [21]. However, E.bovis and E.zurnii are thought to be the primary pathogens in cattle [11]. Bovine coccidiosis is an infectious condition that affects cattle and causes red or bloody diarrhea, dysentery, weight loss, and mortality. According to reports, the disease is worsened by dry, hot, and sunny weather, which is typically thought to be inappropriate for the development of oocysts [20,39]. Due to its economic significance, bovine coccidiosis has garnered interest for a long time. For instance, the annual estimated loss in the United States is $200 million [34].

Dairy herds with significant numbers of calves kept have the worst losses and older cattle continue to excrete oocysts because they are carriers of the condition [31,37]. The disease primarily affects young animals, but it can also affect adults and calves older than six months through the consumption of sporulated oocysts in their contaminated feed or water [33]. The pathogenic consequences of coccidia that enter the small intestine are often less because it determined by the quantity of oocysts they will consume. Ingesting a small number of oocysts won't cause any symptoms, but ingesting a high number could cause serious disease and even death [19].

Disease can affect animals of any age. But, the majority of newborns will likely have been infected and may not exhibit clinical sign of disease during the first several months of life. When an animal's reaches adult, they are very resistant to the parasites' harmful effects, although they may still carry a tiny amount of parasites with them for the rest of their lives. Adult animals with compromised cellular immunity or those which have subjected to stress can develop acute coccidiosis. During the first several weeks of life, colostrum gives passive immunity for newborn animals. Animals then develop coccidia resistance as a result of active immunity as the age is advanced. Unfavorable circumstances like dietary changes, extended travel, variations in temperature, and weather might lower an animal's resistance to coccidia infection [38]. Colostrum-consuming suckling animals might forage less and get fewer oocysts from pasture. Mineral shortages may impact an infection's immunological response [40]. In jimma zone of selected districts of this study area cattle production is extensively practiced and there is no previously study conducted on these selected districts. Therefore, the objective of this study is to determine the prevalence of cattle coccidiosis and associated risk factors in Jimma town and selected surrounding districts.

## Materials and Methods

### Description of study area and period

The study was conducted from August 2021 to January 2022 in Jimma town and the surrounding districts namely: Dedo, Nadhi-Gibe and Seka Chokorsa. Jimma town, the capital of Jimma zone is located in Oromia Regional state at 352km south west of Addis Ababa. In Jimma zone there are 18 Districts. Geographically, Jimma zone has an elevation ranging from 1710-3360m above sea level and located at longitude of 35°52'-37°37'E and latitude of 7°13'-8°56'N. The climatic condition of the area is high land (31%), midland (54%) and lowland (15%). Jimma zone receives annual rain fall ranging from 1200-2000 mm. there are two rainy season in this zone; short rainy season (November - April) and long rainy season (July – October) (JZARDO). The average minimum and maximum annual temperatures were $10^0$C and $30^0$C, respectively. Agriculture is the livelihood for more than 90% of the population in rural farming community around Jimma town. The main agricultural system in the Jimma zone is mixed crop livestock production and animals are mainly produced extensively. The estimated Cattle population of Jimma zone were 2,016,823 [17], and those in study area were estimated to be 127, 300.

### Study animals

The study animals were indiginous local breed of cattle of different Origin, age, sex, and body condition. A total of 512 fecal samples were collected and examined for Eimeria infection from different lactating dairy cows and calves in Jimma Town and Surrounding Districts.

### Study design

A Cross-sectional study was conducted from August, 2021 up to January, 2022 to determine the prevalence of cattle Coccidiosis and associated risk factors in Jimma Town and Surrounding Districts.

### Sample size determination and sampling method

The sample size required for this study was calculated based on sample size determination method for simple random sampling of infinite population according to [36] formula.

$$N = \frac{1.96^2 \, p_{exp} \, (1 - p_{exp})}{d^2}$$

Where,

N = required sample size

$P_{exp}$ = expected prevalence

d = desired level of precision (5%).

Since there was no previous study conducted in this area on cattle coccidiosis, 50% expected prevalence was taken. Accordingly, the sample size was determined to be 768 (384 calves and 384 adults). But due to the fact that, few lactating animals were available during the study period, only 152 calves and 360 adults (n = 512) were considered.

### Sampling strategy

The Study area was selected purposely as to relative large cattle population and due to lack of previous study conducted in these areas on cattle coccidiosis. Sample animals were randomly assigned from 416 households by including and excluding criteria.

### Study Methodology

### Sample collection

### Faecal sample collection

Fresh faeces were collected from 512 cattle (360 adults and 152 calves). Fecal samples (at least 5 grams) were collected directly from the rectum via digital extraction using lubricated glove and

with strict sanitation placed in air and watertight vials then taken to the laboratory. Each feacal sample of 512 cattle was clearly labeled with animal identification, date and place of collection. The faecal samples were placed in a universal bottle, labeled and 10% formalin was added to preserve parasite eggs. Those samples which were not examined within 24 hours of arrival at laboratory were stored at +4°C and examined the next day early in the morning. Body condition evaluation and age determination: Each animal in the particular household was examined to ascertain body condition as documented by Thompson and Meyer [35]. Age determination by dentition formula was done based on formula documented by Sirajudin and Warku [32].

### Coprological examinations

Faecal specimens were processed and examined by floatation technique for qualitative investigation of coccidian ocysts following the standard procedure. ocysts of the coccidia were identified on the basis of their morphological appearance and size (Foreit, 1999). In this study, the floatation solution used was saturated solution of sodium chloride according to [18].

### Data analysis

All data that collected were coded and entered to MS excel sheet and then, analyzed by using SPSS version 20. Descriptive statistics was used to determine the prevalence of the coccidiosis and Chi-square test ($\chi 2$) was used to determine the association between the prevalence of parasite and variables: age, sex, origin, and body condition. In all the analyses, confidence level was held at 95% and $P < 0.05$ was set for significance.

## Results

### Herd demographics and profiles

A total of 512 cattle were sampled from 416 households during this study periods in Jimma town and the three districts. The sample population consisted of 336 (65.6%) females and 176 (34.4%) males. The age grouping of sample population was 152 (29.7%) animals less than 12 months, 62 (12%) animals between 13-18 months, 60 (11.7%) animals between 19-24 months, 43 (8.4%) animals between 25-30 months, 56 (10.9%) animals between 31-41 months, and 139 (27%) animals are old aged. According to body condition score; 54 (10.5%) poor, 176 (34.3%) medium, 282 (55%) good body conditioned animals were evaluated.

### Prevalence of cattle coccidiosis in association with age groups

In current study, out of 512 animals whose faecal samples were examined 153 (29.9%) of samples were found to be positive for coccidiosis. Among animals examined and revealed positive result; 109 were calves with age 2weeks - 12 months, 29 were 13 - 18 months, 10 were 19- 24 months, 2 were 25- 30 months, 1was 31-42 months and 2 were old animals with unknown age. There was statistically significant difference ($p = 0.000$) in prevalence of coccidiosis in cattle of different age groups at $p=0.05$. The highest (71.7%) prevalence was considered in calves less than 12 months old and the lowest (1.4%) prevalence was considered in old animals (Table 1).

| Age | No. Animals examine | No. Positive | | Prevalence (%) | CI (95%) | $X^2$ | P value |
|---|---|---|---|---|---|---|---|
| 1-12 month | 152 | | 109 | 71.7 | [0.6-0.7] | 228.199 | 0.000 |
| 13-18 month | 62 | | 29 | 46.8 | [0.3-0.5] | | |
| 19-24 month | 60 | | 10 | 16.7 | [0.1-0.3] | | |
| 25-30 month | 43 | | 2 | 4.7 | [0.006-0.158] | | |
| 31-42 | 56 | | 1 | 1.8 | [0.001-0.1] | | |
| Old | 139 | | 2 | 1.4 | [0.002-0.051] | | |
| Total | 153 | | | | | | |

**Table 1:** Prevalence of Coccidiosis in cattle as influenced by different age groups.

### Prevalence of cattle coccidiosis in association with origin of animal

Among 512 total sample populations 121(%) were from Jimma town, 131(%) were from Sekka Chekorsa, 140 (%) were from Dedo, and 120(%) were from Nadhi-Gibe Distric. The prevalence of cattle coccidiosis in these four places was 29.8% in Jimma, 29%in Sekka, 31.4% in Dedo and 29.2% in Nadhi-Gibe. There were slight differences in prevalence of cattle coccidiosis in animals of four different origins. However, the difference was only relative and there was no statistically significant difference ($p = 0.971$) in prevalence of coccidiosis based on origin of animals (Table 2).

| Origin | No. Animals examined | | Positive | Prevalence (%) | CI (95%) | $X^2$ | P value |
|---|---|---|---|---|---|---|---|
| Jimma | 121 | | 36 | 29.8 | [0.218- 0.387] | 0.2379 | 0.971 |
| Seka | 131 | | 38 | 29.00 | [0.214-0 .376] | | |
| Dedo | 140 | | 44 | 31.4 | [0.239- 0.398] | | |
| Nadhi-Gibe | 120 | | 35 | 29.2 | [0.212-0.382] | | |
| Total | 512 | | 153 | | | | |

**Table 2:** Prevalence of cattle coccidiosis based on different origin of animals.

### Prevalence of cattle coccidiosis in association with sex of animal

Study population was composed of 336 (65.6%) females and 176 (34.4%) males. The prevalence of infection was 28.4% in male and 30.7% in female. Though there is relative difference in prevalence between sexes; Prevalence of coccidiosis based on sex variation of animals was not considered to be statistically significant ($p = 0.5980$) (Table 3).

### Prevalence of cattle coccidiosis in association with Body condition of animals

Among total sample population 54 were poor, 176 were medium, and 282 were good in body condition score, and the prevalence of coccidia infection was10.5% in poor body conditioned animals 34% in medium body conditioned, and 55.5% in good body conditioned animals. Accordingly, there was no statistically significant difference in prevalence of infection in different body condion scores of animals (Table 4).

| Sex | No. Animals examined | Positive | Prevalence (%) | CI (95%) | $X^2$ | P value |
|---|---|---|---|---|---|---|
| Male | 176 | 50 | 28.4 | [0.219-0.357] | 0.2780 | 0.598 |
| Female | 336 | 103 | 30.7 | [0.258-0.359] | | |
| Total | 512 | 153 | 29.9 | | | |

**Table 3:** Prevalence of cattle coccidiosis in association with sex of animals.

| BCS | No. Animals examined | Positive | Prevalence (%) | CI (95%) | $X^2$ | P value |
|---|---|---|---|---|---|---|
| Poor | 54 | 16 | 29.6 | (0.180-0.436) | 1.7798 | 0.411 |
| Medium | 176 | 59 | 33.5 | (0.266-0.410) | | |
| Good | 282 | 74 | 26.2 | (0.212-0.318) | | |
| Total | 512 | 153 | 29.9 | (0.259-0.341) | | |

**Table 4:** Prevalence of cattle coccidiosis in association with body condition score.

## Discussion

Coccidiosis is a common problem in cattle worldwide [8]. Studies have shown prevalence of *Eimeria* oocyst excretion of up to 8% to 100% at farms in general [5]. Many factors such as the number of ingested oocysts, the presence of a concurrent microbial infection, weather conditions (ambient temperatures and moisture), management in the farms and the functional level of protective immunity may be decisive in whether clinical disease occurs or not [25,38]. The Prevalence of *Eimeria* spp. in healthy animals implies that they can serve as reservoirs of Infection [2].

The study reveals the presence of cattle coccidisios parasitizing the gastrointestinal tract of animals under different ages in Jimma area of southwestern Ethiopia. In present study, the overall prevalence of cattle coccidosisi was 29.9%, which is lower than previous findings reported in Addis Ababa and Debre Zeit by Abebe., *et al.* [1] who reported 68.1%, in the coastal plain area of Georgia (USA) by Ernst., *et al.* [12] who reported 82.28% and in sub-humid tropical climate by Rodriguez-Vivas., *et al.* [30] who reported 87.8% of prevalence. This variation is most likely attributed to the differences in agro-ecology, and husbandry practices of the study animals in different countries [29].

Analysis of risk factor in the association of disease occurrence has revealed that there was no statistically significant association (P > 0.05) between body condition and coccidian 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*. [1], Dawid., *et al.* [12] and Alua., *et al.* [3]. There was no statistically significant asso-ciation (P > 0.05) between sex variation and prevalence of cattle coccidiosis. The prevalence in female animals was similar to that of males in this study. This finding agrees with the report of Abebe., *et al.* [1].

There was no statistically significant association (P > 0.05) between the origin of the animals and coccidian infection. Research performed in other countries has revealed prevalence rates of *coccidia* Varying from 17.9% to 93% in Poland [27,28], 33% in Hungary [14], 22.6% and 33.3% in Brazil [2,26], 35% to 47.1% in China [10,41], 50% in Pakistan [24], 20% and 68% in Ethiopia [1,9], 75% in Turkey [4,7,23], 29%, 50% and 52% in South Africa [22] and 35% in Tanzania [6]. In my study, the infection rate (29.9%) was lower than that reported in other investigations; infection was asymptomatic in all animals similar to studies in Brazil [2], China [41] and Turkey [7].

Age is one of the major risk factors in the spread of coccidiosis; morbidity and risk of infection are greater in calves [1]. In this study, there is Strong association between age groups; and prevalence of coccidiosis. In this study the prevalence of coccidiosis in 2 weeks-12 months, 13-18 months, 19-24 month, 25-30 months, 31-42 months and Unknown aged (old) animals were 71.7%, 46.8%, 16.7%, 4.7%, 1.8%, 1.4% respectively (Table 1). These show that the prevalence of cattle coccidiosis is highly associated with age of individual animals; and it decreases as age of animal increases. These may be due to developed immune status of an animal as age increases. This is consistent with the data of other researchers reporting a strong correlation (P < 0.05) between age groups and infection [1,2,9,10,23,24,41]. Coccidiosis is a self-limiting disease and spontaneous recovery without specific treatment is common when the multiplication stage of the coccidian has passed. This could suggest that previous exposure might have contributed to the development of a certain level of immunity in older calves as compared to the younger ones that did not experience previous exposure [9]. Chibunda., *et al.* [6] and Faber., *et al.* [13] also pointed to the presence of an immature immune system in younger calves resulting in their higher susceptibility to coccidiosis. In contrast, older cattle can develop immunity in response to previous exposure, and hence be more resistant to subsequent reinfections.

In this study, the prevalence was 28.4% in male and 30.7% in female calves Table 3 ($P = 0.598$). Similarly to this finding, Dawid., *et al.* [9] did not find a significant association with sex. The absence of a significant correlation between prevalence and animal sex might suggest that both male and female animals have an almost equal likelihood of being infected with coccidia. The risk of infection of coccidiosis decreases with age as the immunity of the individual mature animal increases in this study.

## Conclusion and Recommendation

In General the study revealed that cattle *coccidiosis* is prevalent in Jimma and surrounding areas farms. However coccidiosis in these three areas presents in the subclinical form and thus no characteristic/overt clinical signs. Younger age groups of calves were strongly associated with the infection of coccidiosis. Integrated strategies should be put into practice to prevent and control *Eimeria* spp. infection on cattle farms. Based on these findings the following recommendations are forwarded

- As early as 15 days of life, the use of prophylactic doses of coccidiostats in ration is advisable to prevent calves from Eimeria infections.
- Isolation and treatment of sick animals to prevent the further disease and premise contamination.
- Better medical attention should also be given to the calves under 12 months of age.
- Introduction of more intense farming methods may be accommodated only if high levels of hygiene are observed and maintained.
- Animals with subclinical coccidiosis act as reservoir for the disease constantly shedding oocyst and thus intense disease management mechanisms should be implemented.
- Farmers should be advised to water their animals from the homesteads or use clean water for their animals.
- Farmers should be encouraged to include coccidiostats in their endoparasites control measures. All measures that minimize the fecal contamination of pastures and premise should be practiced regularly.

- Societies should be aware of the significance of the disease on individual animal as well as out coming production problem associated with the disease so as to keep hygienic and sanitation practices of their production system.

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