

***Eimeria* Infection in Sheep and Dairy Cattle in Akaki Kality Subcity of Addis Ababa, Ethiopia**

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Abstract: A cross sectional study was conducted from November 2016 to May 2017 in Akaki Kality subcity of Addis Ababa, central Ethiopia, to determine prevalence and associated risk factors of *Eimeria* infection in cattle and sheep. A total of 384 randomly selected cattle and sheep fecal samples were collected and examined by centrifugal flotation technique using Sheather's sugar solution to detect the oocysts of *Eimeria*. Accordingly, the overall prevalence was 57.3% with the prevalence of 55.0 % in cattle and 59.8% in sheep showing relatively higher prevalence in ovine than in bovine. However, there was no significant difference ($P>0.05$) in the occurrence of infection between the two animal species; neither of sex and body condition of study animals showed the significance. Significant difference ($P= 0.0007$ in cattle and $P = 0.005$ in sheep) was observed between age groups with high prevalence in young animals than in adults. There was also strong significant difference ($P<0.001$ in both species) in the prevalence of *Eimeria* infection among faecal consistency; the highest prevalence of the infection was recorded in the animals with diarrheic faeces then followed by animals with soft faeces and animals with normal faeces came last. Appropriate monitoring and control of *Eimeria* infection is likely to become a more important problem in small and large ruminants and will have great significance for producers in the future, as the increasing scarcity of land for grazing is forcing people to adopt more intensive management systems. Therefore, planning an effective control and prevention program is essential if the well-being and productivity of sheep and cattle are to be maintained.

Key words: Akaki Kality Sub city • Cattle • *Eimeria* infection • Prevalence • Risk factors • Sheep

INTRODUCTION

Ethiopia, located in Eastern Africa, is predominantly an agricultural nation. Animal production is practiced in all ecological zones of the country [1]. Ethiopia, with its great variation in climate and topography, believed to possess the largest livestock population in Africa. Livestock is a significant contributor to economic and social development in Ethiopia at household and national level. Livestock accounts for 15-17% of total Gross Domestic Product (GDP) and 35-49% of agricultural GDP. Livestock directly contributes to the livelihoods of more than 70% of Ethiopians [2].

Ethiopia, as an estimate indicated, is a home for about 54 million cattle, 25.5 million sheep and 24.06 million goats. From the total cattle population 98.95% are local breeds and the remaining are hybrid and exotic breeds. Sheep local breeds occupied 99.8% and nearly all goat population of the country [3]. According to the report of

Ethiopian Live Stock Marketing Agency [4], (1999), 75% of the total 12.2 million of sheep population in Ethiopia are raised in the highlands, with altitude of above 1500 m.a.s.l. sustaining 92% of the human population. The rest 25% are reared in the low lands. Goats, with a population of 9.5 million, are widely distributed in all agro-climatic zones but with a higher concentration in dry areas.

Ethiopia's great livestock potential is not properly exploited due to many prevailing socio economic values and attitudes, traditional management methods, limited genetic potential and rampant diseases. Gastrointestinal parasite infections are major problem for both small and large scale farms in Ethiopia [5]. Livestock disease is the major constraints of productivity causing economic losses to the peasant farmers and pastoralists in Ethiopia community to hundreds of millions of birr annually [6]. The most important disease problems in the area in the young animals are pneumonia and diarrhea. The important pathogens associated with calf diarrhea are rotavirus,

corona virus, Salmonella species, and protozoan parasites *Eimeria* and *Cryptosporidium* species. Coccidiosis is the common health problem particularly in neonatal calf that is responsible for the greatest economic losses in this age group for both dairy and beef calves and acute diarrhea accounts for approximately 75% of the mortality losses of dairy calves less than 3 weeks age [7].

Coccidiosis is a protozoan disease caused by various species of *Eimeria* [8]. Coccidiosis is responsible for major economic losses in animal husbandry worldwide [9]. Adult animals are usually asymptomatic carriers that often serve as a source of infection for juvenile animals, which are more susceptible to infection [10, 11]. Eimeriosis is the most important parasitic infection in poultry worldwide and it also causes problems in [12]. Eimeriosis affects a wide range of animal species, cattle, sheep, goats, pigs, horses, poultry and rabbits, and is caused by infection with protozoa in the genus *Eimeria*, previously known as *Coccidia* [13].

Eimeria infection 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 most common and important in calves younger than 1 year. All calves managed under conventional systems are exposed and become infected early in life. Many studies indicated that under natural conditions, mixed species infections are much more common than monospecies infections [14]. Eimeriosis 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 have been indicated as an important cause of diarrhea, fever, anorexia, weight loss, emaciation and sometimes death, particularly in young animals (calves) [15].

All age groups of cattle are susceptible to infection, but clinical coccidiosis is most common in young animals. Coccidiosis in cattle commonly occurs as subclinical disease without signs of the disease and involving great economic losses due to reduced appetite, reduced body weight, impaired feed conversion, unthriftiness, diarrhea, dysentery, anemia, and increased susceptibility to other diseases [16].

Oocysts of *Eimeria* spp. are normally present in small numbers in the faeces of healthy sheep of all ages. Disease outbreaks, referred to as coccidiosis, occur when susceptible animals are exposed to infection with pathogenic species. The severity of signs depends on the size of the infecting dose and the susceptibility of the

host [17]. The main symptom of coccidiosis is diarrhoea which can be haemorrhagic in sheep but less frequently than in cattle [18]. Coccidiosis is one of the most economically important infection threatening sheep and goat industry worldwide. It is a protozoan infection caused by coccidian parasite of the genus *Eimeria*. They are intracellular parasite in the epithelium of alimentary tract and it is a self-limiting disease [19].

Infections of Apicomplexan parasites of the genus *Eimeria* infect the gastrointestinal tract of most vertebrates [14]. Damage to the epithelial cells with subsequent reduction in their numbers is reflected histologically by villous atrophy, crypt hyperplasia and cellular infiltration [20]. The pathogenesis of the disease is dependent on the effect of developmental stages of the parasite in various regions of the intestine. The number of oocysts ingested, species of *Eimeria* present, age and immune status of the host, location of the parasite in tissues and number of host cells destroyed determine the severity of the disease. Severe damage to the intestinal mucosa is caused by the second generation meronts and sexual stages of *Eimeria*. Destruction of capillaries in the intestinal mucosa may lead to hypoproteinaemia and anaemia. Secondary bacterial infection can occur and cause severe enteritis. The changes in the intestinal mucosa cause increased rate of peristalsis, malabsorption and diarrhea. Diarrhea is followed by dehydration, acidosis, anemia and terminal shock [21].

Common sources of the infection are adult animals that are asymptomatic parasite carriers, feed and water contaminated with oocysts, feed containers, pens, and personal clothes and tools contaminated with faeces [22]; In addition, nursing dams (direct suckling) that live in poor hygienic conditions (faecal contamination of the udder area) may infect young suckling animals [23]. Clinical disease is common after conditions of stress namely weaning, feed change, shipping and in crowded condition which result in excessive manure and urine contamination [24]. Infection is characterized by acute invasion and destruction of intestinal mucosa, diarrhea, fever, anorexia, weight loss, emaciation and sometimes death. Coccidiosis generally has host species specificity and cross infection between hosts has been documented as impossible [25]. Diagnosis is based on microscopic examination, post mortem examination and symptoms. Finding of a few oocysts in the diarrhoea of animals not necessarily justify the presence of coccidiosis. It is always advisable to depend on necropsy findings than faecal examination [26].

Their life cycle consists essentially of several asexual generations (Merogony) followed by sexual generation ending in the development of oocysts which are passed in the faeces [2]. The life cycle of coccidian is divided into two phases: an exogenous phase and an endogenous phase. The exogenous phase takes place outside of the body in the environment and is called "Sporulation of oocysts". During the endogenous phase, which occurs internally, the parasite undergoes numerous divisions in the intestinal cells. Life cycle takes between 2 and 4 weeks, depending on the species of *Eimeria* [28].

Research on the rate of infection with *Eimeria* protozoa is of great practical importance as it enables the effect of environmental conditions on the course of the infection to be determined. Understanding the sources or causes of infection makes it possible to develop a prevention program for cattle [29]. But in Ethiopia, though diarrhea is an important cause of calf and lamb morbidity and mortality, studies done to quantify the magnitude of the problem and to determine the underlying causes are scant and scarce; information regarding the prevalence of Coccidiosis in the sheep and cattle population of Ethiopia seems to be limited; moreover, there is no record of Eimeriosis in adult animals of bovine species. Although some works have been conducted to determine the prevalence and economic significance of *Eimeria* in few areas of the country, there is no information on the status of this protozoan parasite as a cause of diarrhea in domestic ruminants except a single paper conducted by Abebe *et al.* [11] in Addis Ababa and Bishoftu, central Ethiopia in calves and lambs. Therefore, the objectives of the present study were:

- To determine the prevalence of *Eimeria* infection in cattle and sheep in the study area
- To identify the associated risk factors for the occurrence of the infection

MATERIALS AND METHODS

Description of Study Area: The present study was conducted from November 2016 to May 2017 in Akaki Kality Sub city of Addis Ababa. The sub city is composed of 11 districts where urban agriculture is widely practiced among eight districts except those three districts located in the northeast, east, and southern fringes called districts 09, 10 and 11 (Unpublished source: Akaki Kaliti Sub City UAESP). The sub city is endowed with an abundant soil and water resources suitable for crop and

livestock productions. Based on the data collected from the UAESP, the sub city has the livestock population among which 23, 301 are cattle, sheep and goat, 5, 812 are equines and 27, 580 are poultry chicken. The sub city includes total of 669 farms of cattle. Akaki Kality is situated in the south east part of Addis Ababa that shares boundary with Bole and Nefas Silk Lafto Sub cities in the NE and NW directions respectively, and the rest with the FinfineZuria, Special Zone of Oromiya Regional state [30]. The Addis Ababa, one of the two city-administrations of FDRE, is the capital city of the Federal Democratic Republic of Ethiopia which is located in a high land area with an altitude from 2, 200 to 3, 300 masl. The capital city is located at longitude 38° 44'24"E and latitude 9° 1' 48"N. The annual rainfall is 800-1, 100 mm and gets an average annual rainfall of 1800 mm. The mean annual maximum and minimum temperature is about 21°C and 27°C, respectively. The city has perennial rivers; suitable soil and agro-ecology that help inhabitants to practice crop and livestock production [31].

Study Animals: The study animals were cattle and sheep without regarding their age. A total 384 faecal samples were collected and examined for *Eimeria* oocysts from different dairy farms and small holders found in study area. Examined animals were categorized into two age groups as group I =1 year and group II >1 year, as described in Heidari and Gharekhani [32], which was determined by asking the animal owners and records in the farms. Examined animals were also categorized into three according to their body condition: good, medium and poor. This is based on different body structure, visible bone parts and fat deposit as indicated in the reports of Nicolson and Bajer [33].

Study Design and Sampling Strategy: A cross sectional study design was used to determine the prevalence and associated risk factors of *Eimeria* infection in cattle and sheep from November 2016 to May 2017 in the study area. The first information about dairy farms was collected from the Agricultural office of the sub city and cooperation letter was sent to these farm owners. From these, sampling was done from the farms showing willingness and allow for sampling. Accordingly, sampling frame was established to these farms allow for sampling. Then simple random sampling method was employed to select study cattle. For the ovine, convenient method of sampling was used since there was no recorded information showing the distribution pattern of sheep population in the area.

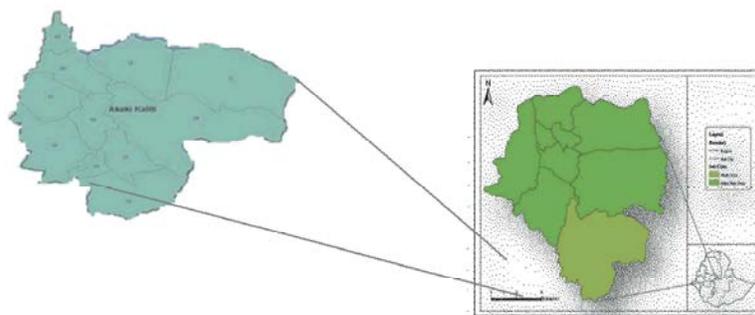


Fig. 1: Location Map of Akaki Kality Sub-City (Study area)
Source: (Endale , 2011 and AASEP, 2013)

Sample Size Determination: The sample size required for this study was calculated based on sample size determination method for systematic random sampling of infinite population after [34] as follows:

$$\frac{1.96^2 * P_{exp}(1 - P_{exp})}{d^2}$$

where,

P_{exp} = expected prevalence

d = desired absolute precision

Since no previous study was conducted in the study area or in the country at all on the bovine and ovine in combined form, the expected prevalence was 50%. Accordingly, with 5% absolute precision at 95% confidence level, the number of ruminants required to determine the prevalence was found to be 384.

Sample Collection: Fresh faecal samples were collected from rectum of the ruminants using rectal glove. Then the collected samples were placed in a labeled clean plastic container (universal bottles) and were transported in ice box to veterinary parasitology laboratory, CVMA, AAU, for processing on the same day. The sample left unprocessed in the first day was stored in refrigerator at 4°C to be processed in the following days. The samples were labeled with a code containing species, sex, age, fecal consistency, and body condition during sample collection.

Sample Processing: A centrifugal fecal flotation technique using Sheather's sugar solution was applied to detect the oocysts of *Eimeria* [35]. The coprological procedure for Sheather's floatation technique was briefly described as follows: taking three grams of faeces from each animal sample and mixing with 10 ml of sugar

solution within beaker. Then it was poured through tea strainer into another beaker and then the solution was added into 15 ml centrifuge tube and placed into the centrifuge. The tube was then filled with sugar solution about 1 inch from the top of the tube without putting cover slip on the tube and centrifuged at 1200 rpm for 5 minutes. Then the test tube was removed from the centrifuge and filled to the top with sugar solution and then covered with cover slip on the tube and kept at standing for 10 minutes. Finally, the cover slip was removed from the tube and was placed on slide labeled with sample code. The entire cover slip was scanned and observed first at 10x and then examined at 40X magnification to identify oocysts according to the criteria for *Eimeria* oocysts identification listed by Bruno *et al.* [36] and results were recorded in the data recording paper as shown in the annex.

Data Analysis: Data obtained from all the tests were coded, managed with regard of risk factors and stored in a Microsoft excel spreadsheet program v2010 (Microsoft, Redmond WA, USA) and analyzed using IBM SPSS version 20 computer Statistical software for windows. The prevalence was calculated for all data as the number of infected individuals divided by the number of sampled individual and multiplied by 100. Pearson's chi-square (χ^2) was used to evaluate the association between the disease and different risk factors. P-value less than 0.05 (at 5% level of significance) was considered as significant in all analysis.

RESULTS

Over All Prevalence and Risk Factors of *Eimeria* Infection in Cattle and Sheep: The overall prevalence of *Eimeria* infection was found to be 57.3%. There was a

Table 1: Overall prevalence of *Eimeria* infection in study animals

Animal Species	No. examined	No of positive (%)	χ^2	P-value
Bovine	200	110(55.0)	0.896	0.344
Ovine	184	110(59.8)		
Total	384	220(57.3)		

Table 2: Prevalence of *Eimeria* infection in Bovine

Risk Factors	No examined	No of Positive (%)	X ²	P-value
Body condition	Good	74	0.429	0.807
	Medium	104		
	Poor	22		
Sex	Male	41	.744	.388
	Female	159		
Age	≤ 1 year	44	7.163	0.001
	> 1 year	156		
	Diarrheic	48		
Fecal consistency	Formed	104	37.89	<0.001
	Soft	48		
Total	200	110(55.0%)		

statistically no significant difference ($p > 0.05$) between the infection and study animal species (cattle and sheep); however, the higher prevalence was observed in sheep than in the cattle (Table 1). Analysis of the potential risk factors has revealed that age ($p = 0.0007$ in bovine and $p = 0.005$ in ovine) and faecal consistency ($p < 0.001$ in both species) were strongly associated with *Eimeria* infection (Table 2 and 3). However, there is no significant association ($p > 0.05$) with sex and *Eimeria* infection, nor with body condition (Table 2 and 3).

***Eimeria* Infection in Cattle:** Out of the examined 159 females, 85 were found positive with the prevalence of 53.5% and from 41 males, 25 were found positive with the prevalence of 61.0%. Accordingly, the prevalence of *Eimeria* infection in male was higher than in females (Table 2), though it is not statistically significant ($p > 0.05$).

In the present study, 156 and 44 young cattle were examined, 78(50.0%) and 32(72.7%) of them were found positive for *Eimeria* infection, respectively. The infection was strongly associated ($p = 0.0007$) with age of animals.

Of the total 200 bovine species examined, 74 were with good body condition and 104 were with medium body condition, 42(56.8%) and 55(52.9%) were found positive for the infection respectively. The remaining 22 were with poor body condition of which 13 were found positive for *Eimeria* oocysts with prevalence rate of 59.1%. This analysis shows that the infection was not significantly ($p < 0.05$) associated with body condition.

Out of the total 200 examined cattle, 48 were found diarrheic of which 40 were positive for *Eimeria* oocysts with prevalence rate of 83.3% and 104 were with formed

feces of which 36 were positive for *Eimeria* oocysts with prevalence rate of 34.6%. The remaining 48 were with soft feces of which 34 were found positive for *Eimeria* oocysts with the prevalence rate of 70.8%. Faecal consistency has also strong significant ($P = 0.000$) association with the occurrence of *Eimeria* infection.

***Eimeria* Infection in Sheep:** Out of 184 total ovine fecal samples collected and examined, 110 (59.8%) were found positive for *Eimeria* oocysts. From the total sheep, 100 were females and 84 were males with 61 (61.0%) and 49(58.3%) positive samples for oocysts of *Eimeria* respectively. Prevalence of *Eimeria* infection was noticeably lower in adult sheep than in the young (Table 3).

Out of 184 ovine fecal samples collected and examined, 22 animals were in good body condition, out of which 14(63.6%) animals were positive for coccidian oocysts, 136 animals were in medium body condition and out of these 76(55.9%) animals were positive for the oocysts and the rest 26 animals were in poor body condition state and out of these 20 (76.9%) animals were positive for coccidiosis. Although the prevalence of *Eimeria* infection in sheep was found to be high in animals with poor body condition (Table 3), when compared with those of medium and good body conditions, the results of the analysis showed that body condition has no significant association ($p > 0.05$) for occurrence of coccidian infections (Table 3).

The study showed that there was a strong significant association ($P=0.000$) in the prevalence of *Eimeria* infection within fecal consistency. The diarrheic animals out of 184 sheep were 34 of which 28 were found positive

Table 3: The Prevalence of *Eimeria* infection in sheep

Risk Factors		No of Examined	No of Positive (%)	X ²	P-value
Sex	Female	100	61(61.0%)	0.135	0.713
	Male	84	49(58.3%)		
Age	≥1 year	67	49(73.1%)	0.7813	0.005
	> 1year	117	61(52.1%)		
Body condition	Good	22	14(63.6%)	4.173	0.124
	Medium	136	76(55.9%)		
Fecal consistency	Poor	26	20(76.9%)	20.077	<0.001
	Diarrheic	34	28(82.4%)		
Fecal consistency	Formed	108	50(46.3%)		
	Soft	42	32(76.2%)		
Total		184	110(59.8%)		

for *Eimeria* oocysts with the prevalence of 82.4% and then it is followed by poor body condition with prevalence of 46.3%(50/108); finally come the sheep with soft faeces with 76.2%(32/42) (Table 3).

DISCUSSION

Eimeria infection is a common problem in cattle and in sheep worldwide [37, 38]. Various prevalence of *Eimeria* infection in cattle and sheep have been reported in various parts of the world. The prevalence of bovine coccidiosis recorded in Ethiopia was within the range of 22.7% and 68 % [39, 40]. The prevalence recorded in some countries had different estimations of prevalence of *Eimeria* spp. in cattle varying from 17.9% to 93% in Poland [41-43], 20%, 68% and 75% in Turkey [44-46], 50% and 52% in South Africa [47] and 29% reported in Iraq by Al-Bakry [48]. In ovine, the recorded prevalence of *Eimeria* infection were 66.8% in Debre Zeit, central Ethiopia by Dinka *et al.* [49], (2009), 22.4% by Lakew and Seyoum [50] in Addis Zemen, Gondar, Ethiopia and 62.7% in and around Haramaya, Estern Hararghe Ethiopia by Muktar *et al.* [51]. In other countries like Tanzania, reported prevalence was 97.5% in sheep by Kambarage *et al.* [52], (1996), 93.9% in Turkey by Arslan and Tuzer [44] and Sisodia *et al.* [53] reported 12.7% prevalence in sheep in India,

The present prevalence of bovine coccidiosis (55.0%) was lower than 68.1% reported in Ethiopia by Abebe *et al.* [11], 93% reported in Poland and 68% reported in Turkey. However, the present prevalence of bovine coccidiosis is higher than 22.7 and 31.9% previous prevalence reported in Ethiopia by Dawid *et al.* [39] and Alemayehu *et al.* [40] respectively and also higher than 29% prevalence reported in Iraq and 50% and 52% reported in South Africa. The differences in estimations of prevalence could be attributed to many factors such as the number of ingested oocysts, the presence of a concurrent microbial

infection, weather conditions and seasons, management, the level of immunity and age, methods of diagnosis and agro-ecology [54-56].

For the bovine, the prevalence was a bit higher in males (61.0%) than in females (53.5%). However, the sex of the animals was not significantly associated ($P > 0.05$) with the infection by coccidia. Similarly to this finding [40] did not find a significant association with sex. The absence of a significant association between the infection and the animal sex might suggest that both male and female animals have an almost equal likelihood of being infected with *Eimeria*. Yet, male animals harbor more coccidia than females; this could be attributed to the less care given to the male animals as compared to the females that are deemed to be future cows which is in line with Dawid *et al.* [39]. The same is true in sheep, but female animals harbor more Coccidia than male ones which is opposite to the prevalence status in sex of cattle; it may be due to less attention toward small ruminants, particularly in small flocks with poor hygienic conditions and no prophylactic treatments against it which is besides the greater physiological stress experienced by female animals in relation to pregnancies and giving birth which is in agreement with Mohammad and Eqbal [57].

Analysis of risk factor in the association of disease occurrence has revealed that there was statistically a strong significant association in both bovine and ovine ($P < 0.007, 0.005$ respectively) between Eimeriosis and age groups. The infection rate in both bovine and ovine ≤ 1 year (72.7%, 73.1%, respectively,) was found higher than age group > 1 year (50.0%, 52.1% respectively); this is consistent with the findings of other researchers who reported a strong significant association ($P < 0.05$) between the age and the infection [58 -61]. Young animals were most commonly infected with *Eimeria* more than Adults. Animals in the young age have been noted as more susceptible to this infection than older animals. If the environment is heavily contaminated it may explain the

findings by a frequent uptake of oocysts resulting in low prevalence from adult animals that would normally have developed some immunity. This could suggest that previous exposure might have a contribution to the development of certain level of immunity of adults as compared to younger that did not experienced previous exposure. This is in accordance with Brian Lassen and Svensson [62]. Age is a major risk factor in spreading of coccidiosis; morbidity and risk of infection are greater in young animals which is in line with Abebe *et al.* [11]. The prevalence of the present study in calves (72.7%) is higher than that of previous prevalence (68.1%) which was overall prevalence of the research conducted in both Addis Ababa (highland) and DebreZeit (midland) by Abebe *et al.* [11], 22.7% and 31.9% previous prevalence reported in Ethiopia by Dawid *et al.* [39] in Diredaw, Easter Ethiopia and Alemayehu *et al.* [8] in Kombolch town, which is found to the North East of Ethiopia in Amhara regional state, respectively This variation could be due to the contribution of various geographical zones on the occurrence of the disease; otherwise the previous prevalence (76.4%) conducted separately in Addis Ababa by Abebe *et al.* [11] was almost in line with the present prevalence (72.7%) in the calves in Akaki Kaliti Sub city of Addis Ababa.

Body condition has no effect on the occurrence of Eimeriosis. Analysis of body condition in the association of occurrence of Eimeria infection has revealed that there was no statistically significant association ($P > 0.05$) in both bovine and ovine species. These indicate that body condition does not have influence on the occurrence of Eimeria infection. This is due to either equal chance of accessing the oocysts or no difference on protective immunity for the disease which agrees with the report of Abebe *et al.* [11].

Fecal consistency showed highly significant ($P < 0.001$) association with the occurrence of infection in both bovine and ovine species. It is higher in diarrheic than non-diarrheic animals in both species. This is in line with the observations of Chibuanda *et al.* [60] and Kennedy [61] and Svensson [62] all of which stated that development of clinical disease depends on the number of oocysts ingested.

CONCLUSION

The result of the present study demonstrated a high prevalence of Eimeria infection in bovine and ovine species with overall prevalence of 57.3%; suggesting that Eimeria infection is still high enough to affect domestic ruminant production in the study area by causing

mortality, morbidity and body condition losses in these animals. This result also indicated that the young animals are most affected groups and the parasite caused clinical diarrhea more commonly in the young animals. The occurrence of Eimeria infection is not affected by the sex, body condition and species of the domestic ruminants (cattle and sheep) as shown in the study. In line with above conclusion, result from this study indicate the Eimeria infection has a great importance for the livestock producers and need a serious control and preventive issue. Therefore, further epidemiological investigation on species composition, economic significance, Different agro-ecology, biology of Eimeriosis, management systems, breeds and seasons should be needed in the study animals.

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