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Study on the Prevalence and Associated Risk Factors of Bovine Eimeriosis in Guangua District, Northwestern Ethiopia

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Abstract

A protozoan disease called Eimeriosis, which affects cattle all over the world, is brought on by different Eimeria species. In the Guangua district of Northwest Ethiopia, this study set out to identify the Eimeria species already present and evaluate the risk factors that go along with them. A cross-sectional study with random sampling was carried out using Coprological methods from July 2019 to March 2020. In this study, the prevalence of coccidia species was 17.83% (82/460), with *Eimeria bovis, Eimeria zuernii* and mixed infections having a respective prevalence of 7.83%, 3.25%, and 6.74%. The severity of coccidia (Eimeria) infection was shown to be statistically significant (p 0.05) when cattle age and month of the year were taken into account. The season, sex, or breed of cattle did not, however, appear to be associated with coccidial infection in statistically significant (p > 0.05) ways. The study area had a moderate prevalence of cattle Eimeriosis. To implement strategic control and prevention measures, it is, therefore, necessary to conduct a study using molecular techniques to identify Eimeria species and to raise cattle owners' awareness of management practices.

Keywords: Cattle; Eimeriosis; Coprology; Guangua district; Prevalence

Introduction

The majority of the world's cattle are thought to be affected by gastrointestinal parasites, which reduce productivity and waste through mortality, morbidity, stunted growth, weight loss in young calves, delayed maturity of slaughter stock, decreased production of milk and meat, and decreased animal working capacity, particularly in Ethiopia [1-5].

Several Eimeria species, including *E. bovis, E. zuernii*, and *E. auburnensis*, which are the most widely distributed species globally, are responsible for the most prevalent protozoan disease in cattle raised in intensive farming systems, cattle eimeriosis [6-9]. On the other hand, E. zuernii and E. bovis are thought to be particularly dangerous to cattle, causing illness and even death [10,11].

Age, consumption of oocysts, the presence and types of production, and management techniques all have an impact on eimeriosis in cattle [8,12]. Young animals have a higher risk of contracting eimeriosis infections because their immune systems are still developing [13-17]. Animals with the infection excrete unsporulated oocysts in their waste, contaminating the environment. Oocysts sporulate when they turn infectious and develop double cyst walls to shield them from the outside environment [17]. Time, temperature, and moisture all play a role in sporulation, which can take place in a few days or a few weeks [18]. By consuming contaminated feed and water or by grooming themselves, cattle consume sporulated oocysts [19].

There are many cases of eimeriosis in cattle, and it has a serious financial impact [20]. Subclinical Eimeriosis is more significant than clinical Eimeriosis and might be responsible for more than 95% of all losses connected to Eimeriosis [4]. Clinical eimeriosis symptoms include decreased appetite, exhaustion, weight loss, poor feed conversion, thriftiness, diarrhea, anemia, dysentery, and anemia [13,21]. Cattle of all ages can contract eimeriosis [22,23], but because young animals' immune systems are still developing, it is most prevalent and dangerous in those between the ages of three and six months [24]. Additionally, environmental stressors like weaning, dietary changes, harsh environments, inadequate nutrition, poor sanitation, and overcrowding can all increase the risk of infection and disease [25].

Despite the fact that similar analyses of the incidence and risk of cattle eimeriosis in various regions of Ethiopia have been performed and have revealed prevalences ranging from 19.01% to 72.4% [10,11,26-28,29-38].

It should be noted that because Ethiopia is a large country with a large population of livestock, mostly cattle, most studies don't cover the entire country but instead concentrate on particular regions [34]. The current study region also did not contain any published research on cattle eimeriosis. As a result, the goal of this study was to evaluate the risk factors related to Cattle Eimeriosis, ascertain its prevalence, and identify the Eimeria species that are currently present in the Guangua district of Northwest Ethiopia.

Materials and Methods

Study Area

The study was conducted in the district of Guangua, which is 505 kilometers northwest of Addis Abeba, Ethiopia's capital city, 179 kilometers southwest of Bahir Dar, Amhara, and 57 kilometers from Injibará, the administrative center for the Awi region. A report from the Guangua District Annual Statistical Magazine states that it is situated between 1600 and 1710 meters above sea level, with an average annual rainfall of 1550 mm and an average annual temperature of 23.5°C (22–25°C). Intensive livestock control is used in the farming method of mixed agricultural crop and livestock. In total, there are 23598 beehives, 918 horses, 9645 donkeys, 2385 mules, 144851 cattle, 35740 sheep, 22955 goats, and 2385 mules living in the area. 2020's Abaynew and Haben as well as 2018's Guangua District Administration Office

Study Animals

From different peasant associations in the districts, 460 cattle were randomly chosen (including Bizra Kani, Tiru birhan, Waikela, Semen degera, and Yimali). According to the study by kemal and terefe [39], both male and female cattle of different breeds and ages were taken into consideration. The cattle were divided into three age groups: calf (less than one year old); young (1 to 3 years old); and adults and olds (>3 years old). An extensive communal grazing system was used to manage all of the sampled cattle.

Inclusion criteria: The study covered all breeds of cattle that were extensively managed by both sexes, age groups, and different age groups.

Exclusion criteria: In this study, confounding variables were avoided by excluding multiple animal samples from the same herd during sampling.

Study Design

In order to assess the associated risk factors, ascertain the prevalence of Cattle Eimeriosis, and identify the existing Eimeria species in the Guangua district, Northwest Ethiopia, a cross-sectional study was carried out between July 2019 and March 2020.

Sampling Method and Sample Size Determination

Using a random sampling method, the study animals were chosen from various peasant associations (kebeles), and the total number of sampled cattle was calculated using the Thrusfield formula [40].

$$N = \frac{(1.96)^2 * Pexp (1-Pexp)}{d^2}$$

Where N = required sample size, Pexp = expected prevalence, (50%), and d = desired absolute precision (0.05). Although 460 cattle were sampled for the current study in order to increase precision, the formula above indicated that 384 samples were required.

Study Method

Coproscopical techniques: Fecal samples weighing 30 g were taken with a sterile disposable plastic glove either directly from the rectum or occasionally from recently passed feces. The samples were transported to the parasitology laboratory in a cool icebox on the same day they were collected, where they were stored in a clean plastic container and kept at a refrigerated temperature until processing within 48 hours of arrival. The sampling was documented along with the season, owners' names, addresses, identification numbers, age, sex, and breed of the animals. A flotation technique using a saturated sodium chloride solution was used to check for oocysts in fecal samples [41]. The morphology of the oocysts and sporocysts (shape, color, form index, micropyle and its cap, presence or absence of residual, polar granule), as well

as the timing of sporulation, were used to identify the Eimeria species [41-43]. At least ten oocysts from each species were morphologically characterized for identification [6].

Data Management and Statistical Analysis

The 2016 Microsoft Excel worksheet was used to enter the data on the Eimeria species of cattle and the risk factors connected to them. STATA version 13 was then used to analyze the data. The prevalence was calculated using descriptive statistics like percentages. The chi-square test was used in statistical analyses to examine relationships between explanatory variables (risk factors) and status variables (outcome variables). Univariate logistic regression was used to assess each risk factor's relationship to the outcome variable. A p-value of less than 0.05 was regarded as indicating a statistically significant association.

Results

Overall Prevalence of Eimeriosis in Cattle and its Associated Risk Factors

Eimeria zuernii had a prevalence of 3.25%, while *Eimeria bovis* had a prevalence of 7.83%, mixed infections with both species had a prevalence of 6.74%, and mixed infections with *Eimeria zuernii* had a prevalence of 6.74% in the current study. Age, sex, breed, and season were taken into account as potential risk factors in the study area. Calves had the highest prevalence of coccidia infection (31.1%), followed by adults and older people (20.49%) and children (10.53%), according to the study on the prevalence of eimeriosis across all age groups. Coccidia infection and cattle age were statistically significantly associated (p=0.003). Compared to male cattle (16.78%), female cattle (18.33%) had a slightly higher prevalence of coccidia infection, as shown in table 1.

When it comes to the breed of the cattle, Holstein Friesian x indigenous zebu cattle (9.68%) saw a higher percentage of coccidia infections than indigenous zebu breed cattle (l8.41%). Coccidian infection was more common (19.5%) during the dry season than it was (16.54%) during the wet season. The relationship between coccidia infection and sex, breed, or season of occurrence, however, was not statistically significant (p > 0.05).

When compared to young cattle, calves had 1.8 times the likelihood of contracting coccidia infection (CI, 0.59–5.46) as compared to young cattle (CI, 0.13-0.94), while old cattle remained unaffected. However, while crossbred cattle were maintained constant, the likelihood of local or indigenous breeds of cattle harboring coccidia infection was 8.97 times higher (CI, 0.35-227.40). While infection during the dry season remained constant, the likelihood of contracting coccidia increased by 0.69 times (CI, 0.0.12-4.07) during the wet season (Table 1).

Risk Factors	Categories	No. of examined cattle	No. of infected cattle	Proportion (%)	Odds ratio	95% CI (Lower-Upper)
Age	Calf (<1 year)	45	14	31.1	1.8	0.59-5.46
	Young (1-3years)	171	18	10.53	0.35	0.13-0.94
	Adults & Olds (> 3years)	244	50	20.49	1	1
Sex	Male	149	25	16.78	0.82	0.35-1.95
	Female	311	57	18.33	1	1
Breed	Local	429	79	18.41	8.97	0.35-227.40
	Crossbreed	31	3	9.68	1	1
Season	Dry	200	39	19.5	1	1
	Wet	260	43	16.54	0.69	0.12-4.07
	Overall prevalence 17.82					

Table 1: Univariate logistic regression analysis of cattle eimerosis with its associated risk factors.

Frequency of Eimeria Infection to Months of the Year

In the current study, the frequency of Eimeria infection in cattle was identified throughout the yearly months. The months with the highest rates of Eimeria infections were February (30%), November (26%), December (20%), July (18.2%), and October (18%), whereas the months with the lowest rates of coccidia infections were August (7.27%) and September (14%). Months of the year and the presence of coccidian parasites were found to be statistically significantly correlated (x2=16.07, p=0.041) (Table 2).

Months	No. of cattle examined	No. of cattle infected	Prevalence (%)	Chi-square ($X^{2)}$	p-value
January	50	9	18	16.07	0.041
February	50	15	30		
March	50	5	10		
July	55	10	18.2		
August	55	4	7.27		
September	50	7	14		
October	50	9	18		
November	50	13	26		
December	50	10	20		
Total	460	82	17.82		

Table 2: Monthly prevalence of Eimeriosis in cattle in the Guangua district.

Discussion

The disease known as eimeriosis, which is brought on by the protozoan parasites of the genus Eimeria, affects cattle frequently all over the world and has a significant economic impact [44,45]. In this study, eimerosis in cattle was found to be 17% prevalent overall. This prevalence was comparable with the results of [10,31,37,46-49] who reported a prevalence of 18.5% in Sekela district, 20% in Debre Zeit, 21.1% in and around Gondar area, 22.7% in Dire Dawa, 24.9% in Bahir Dar, 24.4% in Haramaya and 22.9% Wolaita Sodo town, respectively. The prevalence of Eimeria species, however, was lower than that reported by Alemayehu, et al. [27], Asfaw, et al. [28], Yadeessa, et al. [11], and Abebe, et al. [13], who reported prevalences of 31.9% in Kombolcha, 62.5% in Asella, 51.42 % in Jimma, and 68.1% from Addis Ababa and Debre Zeit, respectively. Due to variations in agroecology, study season, and husbandry practices, there is a discrepancy in the prevalence of cattle Eimeriosis [34,49].

Two pathogenic Eimeria species—*Eimeria bovis* (7.83%), *Eimeria zuernii* (3.25%), and mixed infection of both species (6.74%)—were found in the current study. Data from Heidari, et al. [50a], Ernst, et al. [12], Kasim and Al-Shawa [51], Cicek, et al. [52] Farkas, et al. [53], and Almeida, et al. [6], who reported a high prevalence of *E. bovis* and *E. zuernii* in their study, were in agreement with this. While *E. zuernii* and *E. bovis* were the most common species in cattle, according to other authors like Kennedy and Kralka and Cornelissen, et al. [54] clinical Eimeriosis was not seen in those animals. Due to poor feed performance, sluggish weight gain, loss of mass, failure to mature fully, and increased susceptibility to other diseases, the high prevalence of subclinical infections in infected calves can negatively affect animal productivity and cause financial losses [49,41]. Additionally, in these regions, continuous oocysts from subclinically infected cattle also contaminate the veal environment and severely infect new cattle, who are extremely vulnerable to Eimeriosis [55,56].

The prevalence of cattle Eimeriosis among the potential risk factors revealed a statistically significant difference (p 0.05) with the age of the cattle, which was found to have concurred with prior findings [27,49,57]. Eimeriosis was prevalent in calves at a rate of 31.1%, but it was only 20.4% prevalent in adults and older age groups. This observation agreed with earlier reports from Damana, et al. [49] and Abebe, et al. [13]. Calves had 1.8 times (CI, 0.59-5.46) more chance of shedding Eimeria oocysts than young cattle (OR, 0.35; CI, 0.13-0.94). This was in line with reports from Heidari, et al. [50a], Chibunda, et al. [58], Abebe, et al. [13b], Nalbantoglu, et al. [59]. Because calves' immune systems have not developed as well as those of young animals and adults, this is likely due to a number of factors [23,57]. In addition, Chibunda, et al. [58] and Faber, et al. [21], noted the occurrence of Eimeriosis in calves that was connected to their weakened immune systems, which may have made them more susceptible to Eimeria infection [60-62]. On the other hand, older calves may develop antibodies to earlier diseases and become more resistant to reinfections.

According to this study, Eimeria infections were more common (19.5%) during the dry season than they were during the wet season (16.54%). The occurrence of Eimeria infection, on the other hand, did not have a statistically significant relationship with the season ($p > 0.05$). Deworming cows, which encourages oocyst survival and sporulation during wet seasons, is most likely to blame for this [23].

Conclusion

According to this study, the Guangua district has a high prevalence of cattle eimeriosis. Among potential risk factors, the age of the cattle showed a statistically significant difference with Eimeria infection. Therefore, it is advised to conduct additional research using molecular methods for identifying Eimeria species and educating cattle owners about management practices in order to implement strategic control and prevention measures to lower the prevalence of Eimeria.

Declarations

Ethics Approval and Consent to Participate

The best practice guidelines for veterinary care were followed and those cattle owners were informed as to the purpose of the study, and that the Wolaita Sodo University of Research Ethics and Review Committee approved the protocol of the study with the reference number WSU 41/22/2241 and the verbally informed consent process in the manuscript. The purpose of the study was well explained to the cattle owners before taking the samples, and informed consent was obtained to take the appropriate sample through verbal consent.

Consent for Publication

Not applicable.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author, [Haben], upon reasonable request.

Disclosure Statement

All authors declare no competing interests.

Funding Statement

The current study was conducted without the support of funding sources.

Authors' Contributions

HF contributed to study design, data collection, data analysis, and manuscript writing and editing; IA: manuscript rewriting, reference search, and re-editing. All authors approved the manuscript submission.

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