Poultry coccidial infection in local chickens from three selected districts of North Gondar Zone, Ethiopia

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Abstract

A cross-sectional study was conducted to determine the prevalence of poultry coccidial infection and to identify *Eimeria* species on local chicken in three selected districts of North Gondar, Northwest Ethiopia from October 2010 to March 2011. Two hundred sixty local chickens were purchased from three selected districts (Wogera, Dembya and Gondar town) which represent two agro-ecological zones. Identification of *Eimeria* species was based on the Oocyst morphology, predilection site, gross and histopathological changes in the intestine. The study indicated that 16.92% (44/260) of the chickens were infected with coccidia oocysts. Four *Eimeria* species were identified, namely, *Eimeria maxima, Eimeria acervulina, Eimeria necatrix* and *Eimeria tenella* with the prevalence estimate of 36.3%, 29.5%, 18.2%, and 15.9%, respectively. Age unlike sex was found to be significantly ($P < 0.05$) associated with coccidial infection. This study showed that coccidial infection (16.92%) could be important in the backyard system which was supposed to be low.

Keywords: Coccidial infection, *Eimeria species*, Ethiopia, Local chicken, Prevalence

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Introduction

In Ethiopia, poultry production is categorized into traditional, small and large scale sectors, which is based on the objective of the producer, the type of input used, and the number and types of chickens kept (Alemu Yami, 1995). The rural poultry sector constitutes about 99% of the total chicken population and managed under the traditional village poultry production systems (Tadelle Dessie *et al*., 2003). Rearing of scavenging chickens is constrained especially by disease and predation problems (Takele Taye and Oli Wakeyo, 2011). In recent years in connection with the growing poultry sector, coccidiosis is receiving due attention. And because of this it is becoming among the researchable areas

(Fessessework Guale, 1990; Hagos Ashenafi, 2000; Methusela, 2001; Fikre Lobago *et al*., 2003; Safari *et al*., 2004; Getachew Gari *et al*.; 2008; Mersha Chane *et al*., 2009). According to Methusela (2001) and Safari *et al*. (2004) coccidiosis resulted in 8.4% and 11.86% losses in profit in large and small scale farms, respectively. Among the species of *Eimeria* reported in Ethiopia include *Eimeria acervulina, Eimeria necatrix, Eimeria maxima* and *Eimeria tenella* (Safari *et al*., 2004). However, the available information in the backyard production system was still limited particularly in North Gondar Administrative zone. This study was conducted to estimate the prevalence and distribution of poultry coccidial infection and to identify the prevalent *Eimeria* species in local chickens in North Gondar, Ethiopia.

Materials and Methods

The study area

The study was conducted in North Gondar zone of Amhara National Regional State representing two agro-ecological zones; highland (Wogera) and midland (Gondar town and Dembya). The study area lies approximately 550 m (in Western lowland) to 4,620 m (Semen Mountain in North) above sea level with an average annual rainfall varying from 880 mm to 1,772 mm and characterized by unimodal type of distribution. The mean annual minimum and maximum temperature was 10°C in the highland and 44.5°C in the lowland respectively. Geographically the area lies between 12.3-13.8°N latitude and 35.35°E longitude (Central Statistical Authority, 2009).

Study animals and management

A total of 260 local chickens of both sexes (male and female) of different age groups (grower and adult), were bought on market days from the respective selected districts. The chickens were then transported to University of Gondar, Faculty of Veterinary Medicine Parasitology Laboratory for ante-mortem, postmortem and laboratory examination. The poultry management in the study areas was entirely free ranging system.

Study design, Sample size determination and sampling method

A cross sectional study was used to determine the prevalence of coccidial infection in local chicken and to identify the prevalent *Eimeria* species in the study area. It was conducted from October 2010 to March 2011. The sample size was determined taking expected prevalence rate of 11% (Fikre Lobago *et al*., 2003),

95% confidence level and 5% absolute precision (Thrusfield, 2005). The sample size was calculated to be 151 birds; however, to increase the precision 260 birds were sampled. The assumption of equal proportion (80 to 90 chickens) was considered to determine the number of chicken to be sampled from each district as the population number was not available for calculating proportion. The chickens were purchased from the respective district market and selection was random.

Faecal sample collection and examination

The chickens were kept overnight in a cartoon and a clean plastic wrap was placed in each cartoon for each bird to collect fecal sample. The faeces of each bird was put in a petri-dish and mixed with intestinal scraping, which was taken after postmortem and the pooled sample was blended by mortar and pistol. Floatation technique using sugar solution was applied to harvest Oocyst as described by Bowman (2003). The average length and width of the Oocyst was measured using ocular micrometer from at least 3 to 5 Oocysts to determine their size. The chickens were kept in the laboratory for at least 18 hours to record ante- mortem and clinical condition of each bird.

Postmortem examination

The chickens were euthanized by cervical dislocation using the technique described by Zander (1978) and eviscerated, after which the intestinal tract was opened. The intestinal walls were examined for thickening, petechiae, coagulation necrosis, reddening, whitish spots, cecal cores, or bleeding. The observed gross pathological lesions were recorded with their specific sites.

Histopathological examination

Tissue samples of intestines about 1-3 cm length for histopathological examination were sampled and fixed in 10% neutral buffered formalin. The tissue samples were dehydrated in alcohol, cleared in xylene, embedded in paraffin, sectioned at 5µm thickness and stained with haematoxylin-eosin (Luna, 1968). The stained samples were examined by light microscope for histological changes.

Identification of species of *Eimeria*

Speciation of *Eimeria* was performed by microscopic features of Oocyst morphology (shape, size and color of the Oocysts), the preferred location of *Eimeria* in the gut, the nature of gross lesions induced and histopathological finding as described by Conway and Mckenzie (2007).

Data analysis and management

The data collected was checked, coded and entered in to Microsoft excel. Stata 7 (Stata Corporation, 2001) statistical program was employed for the data analysis. The prevalence of coccidial infection was determined by dividing the number of positive samples by the total number of chickens examined for coccidia and was expressed as percentage. Chi-square test (Fisher's exact for data with a frequency of less than five in a cell) was used to assess if there was a statistically significant difference in poultry coccidial infection between sex, different location, age, clinical and sub clinical coccidiosis. For this analysis p-value less than 0.05 was considered as significant.

Results

Prevalence of coccidial infection

From a total of 260 chickens examined, 44 (16.92%) were infected with *Eimeria* species. The highest prevalence (20%) was observed in chickens originated from Wogera representing the highland area, followed by 17.5% of Gondar town and 13.33% of Dembya representing midland (Table 1). Even though prevalence of coccidial infection was relatively higher in highland, the difference was not statistically significant (Table 1). There was a significant difference in poultry coccidial infection between different age groups where growers were more affected than adults (Table 1). The effect of sex on the coccidial infection prevalence was assessed and relatively high prevalence was recorded in male chickens (18.85%) than that of females (15.22%) (Table 1). However, the difference between sex groups was not statistically significant.

Table 1: Prevalence of coccidial infection with respect to district, age and sex.

Factors	Category	No. examined	No. positive	Prevalence in % (95% CI*)	p-value
District	Wogera	90	18	20 (11.7- 28.3)	0.484
	Gondar town	80	14	17.5 (9.2-25.8)	
	Dembya	90	12	13.33 (6.33-20.33)	
	Total	260	44	16.92 (12.32-21.52)	
Age	Adult	217	26	11.98 (7.68-16.28)	0.000
	Grower	43	18	41.86 (27.16-56.56)	
	Total	260	44	16.92 (12.32-21.52)	
Sex	Male	122	23	18.85 (11.95-25.75)	0.435
	Female	138	21	15.22 (9.22-21.22)	
	Total	260	44	16.92 (12.32-21.52)	

*CI = Confidence interval

Of the four *Eimeria* species identified, *E. maxima* and *E. acervulina* occurred most frequently with prevalence of 36.3% and 29.5%, respectively. Prevalence of *E. tenella* (15.9%), and *E. necatrix* (18.2%), were comparatively low (Table 2).

Table 2: Pathogenic *Eimeria* species identified in three districts.

Districts	*E. acervulina*	E. maxima	E. necatrix	*E. tenella*	Total
Wogera	5(27.8[a])	7(38.9)	3(16.7)	3(16.7)	18 (6.92)
Gondar town	5(35.7)	5(35.7)	2(11.7)	2(11.7)	14 (5.38)
Dembya	3(33.3)	4(33.3)	3(25)	2(16.7)	12 (4.62)
Total	13(29.5)	16(36.3)	8(18.2)	7(15.9)	44 (16.92)

[a] Numbers in the parentheses are percentages (%)

Clinical Case Findings

During ante-mortem, chicken that showed depression, ruffled feather, diarrhea or blood mixed droppings were recorded as clinical cases. Five (1.92%) of the 260 examined chicken, showed clinical coccidiosis with characteristic signs and lesion in the intestine and caecum, while the rest 39 (15%) were positive for subclinical coccidiosis (Table 3).

Table 3: Prevalence of clinical and subclinical coccidiosis in local chicken in three selected districts.

	Clinical	Sub clinical	Total
Positive	5	39	44
Negative	255	221	216
Prevalence	1.92(%)	15(%)	16.92(%)

Discussion

In traditional poultry production system, the input required is minimal and is considered as secondary to other agricultural activity by smallholder farmers. Coccidial infection in this system is not known to farmers and also overlooked by public and private veterinary services (Getachew Gari *et al*., 2008). However, the 16.92 % prevalence in the present study underscores the importance of the coccidial infection in this system as well. The prevalence of coccidia infections in local chicken in this study was relatively comparable to the findings of Fikre Lobago *et al*. (2003) who reported 11% in backyard rearing system and lower than the findings reported from other parts of Ethiopia by Hagos Ashenafi *et al*. (2004) and Getachew Gari *et al*. (2008) with prevalence of 25.8% and 61.25%, respectively. This difference might be due to variation in density of chickens kept in the study area, season of the year and agro-ecology. Compared to the intensive commercial production system, the prevalence of coccidial infection in scavenging chickens was low. Coccidial infection becomes more important in birds reared under intensive system as the system permits the build-up of infective oocysts in the environment and aggravates the infection further (Agri-facts, 2001). Shirzad *et al*. (2011) in Iran and Karaer *et al*. (2011) in Turkey reported 75% and 54.3% subclinical coccidiosis in broiler farms, respectively.

Four economically important species of coccidia namely *E. tenella, E. acervulina, E. necatrix* and *E. maxima* were found in this study, which is in agreement with the previous reports in Ethiopia (Methusela *et al*., 2002; Hagos Ashenafi *et al*., 2004; Getachew Gari *et al*., 2008). *Eimeria maxima* and *Eimeria acervulina* were the most prevalent *Eimeria* species found in the current study with prevalence rate of 36.3% and 29.5%, respectively which is also in agreement with the work of Jordan *et al*. (2002).

In the present study, the occurrence of coccidial infection was significantly associated with the age of birds. The relatively higher prevalence of coccidial

infection recorded in young birds as compared to adults could be associated with the difference in immunity which might be lower in the former (Jordan *et al*., 2002). The occurrence of subclinical coccidiosis (15%) was significantly higher than clinical coccidiosis (1.92%) in local chickens. This could be due to the fact that local chickens might be repeatedly exposed to different species of *Eimeria* and boost their immunity. The existence of subclinical coccidiosis in local chicken indicated the possibility of backyard chickens acting as a source of infection (Hagos Ashenafi *et al*., 2004). Still some local chicken developed clinical coccidiosis. And this could be associated with the feeding habit of local birds (scavenging) where the likely contact with sporulated oocysts in faeces and concurrent parasitoses would be high.

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