

Study of The Prevalence, Species Identification and Risk Factors Associated with Poultry Coccidiosis in Gondar Town, North Ethiopia

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Abstract: A cross sectional study was conducted from November 2015 up to April 2016 in Gondar town to determine the prevalence of poultry coccidiosis, to identify the associated risk factors and to identify *Eimeria* species involved in the disease. A total of 407 birds were used for the study from different areas of Gondar town. Fecal samples were taken from all the 407 study chickens examined by floatation method to detect *Eimeria* oocysts and identify species. The result revealed that out of the 407 chickens, 218 (53.6%) of the chickens were found positive for coccidiosis. The prevalence was found statistically significantly different ($P=0.001$) between different age groups which was 66.1% in young chickens and 43.3% in adult chickens. A statistically insignificant difference ($P = 0.986$) in prevalence of coccidiosis was noted across breeds of chickens, with the prevalence of 54.1%, 53.3% and 53.2 % in local, cross and exotic respectively. There was a significant difference ($p=0.001$) in prevalence of coccidiosis among the different housing systems with the prevalence of 28.6% in Floor, 60.8% in Backyard. There was no statistically significant difference ($p= 0.698$) in the prevalence between male (54.9%) and female (52.9%) chickens. The effect of body condition on the disease prevalence was significant in which higher prevalence was recorded in those chickens which have poor body condition (69.5%) than those chickens with good body condition (39.6%). This study showed that coccidiosis was prevalent in the study area. Body condition, age, housing system and management system were found as important risk factors. The most frequent species are *Eimeria necatrix*, *Eimeria tenella* and *Eimeria acervulina*. This signifies the need for intervention through awareness creation among farmers and veterinarians.

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Key words: Coccidiosis; *Eimeria* species; Ethiopia; Gondar; Prevalence; Risk Factors

1. Introduction

In developing countries poultry production offers an opportunity to feed the fast growing human population and to provide income for resource poor farmers. Moreover, poultry in many parts of the modern world is considered the chief source of not only cheaper protein of animal origin but also of high quality human food (Jordal *et al.*, 2002). Ethiopia has large poultry population estimated to be 56.5 million (CSA, 2011). Three types of poultry production systems are identified in Ethiopia (Yami and Taddele, 1997). These are backyard poultry production system, small scale and large-scale intensive poultry production systems. The main objective of rearing chicken in all production systems is concerned with egg and meat production, for income generation and home consumption (Nasser, 1998).

Coccidiosis is one of the most important worldwide diseases of poultry, the disease caused by protozoa of the Phylum Apicomplexa, family

Eimeriidae, which undergoes a direct life cycle with transmission between hosts by way of resistant (sporulated) oocysts. Coccidiosis has been a major cause of poor performance and lost productivity in poultry and other farm animals. In poultry, most species belong to the genus *Eimeria* and infect various sites of the intestine which grows and multiplies in the intracellular epithelial and sub epithelial cells, usually in the gut inducing enteritis.

The infectious process is rapid (4-7 days) and is characterized by parasites replication in host cells with extensive damage to the intestinal mucosa. Affected birds become depressed, have ruffled feathers, the wings droop, have diarrhea and tend to huddle. Food and water consumption usually decreases and may become emaciated and dehydrated. Laying hens will experience a reduction in rate of egg production. Poultry coccidian are strictly host-specific, and the different species parasitize specific parts of the intestine (Jordan, 1995). *E. Tenella* and *E.*

Necatrix are the most pathogenic species. *E. acervulina*, *E. maxima* and *E. Mivati* are common and slightly to moderately pathogenic; *E. brunetti* is uncommon but pathogenic when it does occur. *E. mitis*, *E. praecox* and *E. Hagani* are relatively non-pathogenic species (Soulsby, 1982; Lillehoj and Trout, 1993).

Coccidiosis is endemic in Ethiopia, causing great economic losses, particularly in young growing birds in all production systems. In Ethiopia, *E. necatrix*, *E. maxima* and *E. tenella* are endemic in all parts of the country and affect many young growing birds. In the past years coccidiosis used to be the most important cause of mortality in all farms. Incidences of the disease were as high as 80% usually occurring in the form of outbreaks (Safari *et al.*, 2004).

The disease contributed to be a problem with prevalence rate of 50.8% and 11% in deep litter intensive system and backyard poultry production systems respectively. Although in Ethiopia quantitative losses due to coccidiosis are not well documented, reports indicate that the disease contributes to 8.4% and 11.86% loss in profit in large scale farms and small scale farms respectively (Kinung *et al.* 2004).

With increasing interest in poultry production evidenced by the proliferation of poultry farms, it is pertinent to continually evaluate the prevalence, frequencies of the different *Eimeria* species and management issues associated with common poultry diseases such as coccidiosis (Reid, 1990). Such studies did not exist in study area. The objective of this study was therefore to estimate the prevalence of poultry coccidiosis, identify the risk factors of poultry coccidiosis and identify the *Eimeria* species which cause coccidiosis in poultry in the study area.

2. Materials and Methods

2.1. Study Area

The study was conducted in Gondar city, capital of North Gondar zone in Amhara regional state. The city is located between 12°36'N 37°28'E and 12.6°N 37.467°E with an average temperature of 20°C and an average annual rainfall of 1800 mm. In this study areas people practice poultry production by using different rearing systems like cage, floor and backyard production systems which are currently becoming popular and deep litter. Both local and exotic poultry breeds are available in this study area.

2.2. Study Population

The study was conducted on chickens in selected chicken keeping households of Gondar town. The information regarding age, breed, body condition and short interview of owners about the management and housing type of their chicken was made. Chickens were kept under backyard, floor or cage husbandry

system. The study birds were grouped by sex (male and female), breeds (White leghorn, Brown cucar and local) and by age (as young (less than three months) and adult (greater or equal to three months) (Comfort *et al.* 2013).

2.3. Study Design

The study design was a cross sectional study design in which study birds were examined and sample collected once during the study period from November 2015 to April 2016 to determine prevalence and risk factors of poultry coccidiosis in Gondar town.

2.5. Sampling Method and Sample Size Determination

A roughly systematic sampling method was employed to determine prevalence and associated risk factors of poultry coccidiosis in the study area. The desired sample size for the study will be calculated using the following formula (Thrusfield, 2005) with 95% confidence interval, 5% absolute precision and the expected prevalence of coccidiosis 43% which is taken from previous work at Gondar town (Hadyas *et al.*, 2013).

$$n = \frac{1.96^2 \times P \exp (1 - P \exp)}{d^2}$$

Where, n = the required sample size, P exp = expected Prevalence, d = absolute precision.

Accordingly, the sample size calculated is 377 poultry. However, to increase the precision; by adding 30 to the sample 407 chickens were sampled.

2.3. Study Methodology

Feecal Sample Examination: Freshly deposited fecal samples of chickens of different ages, breed and sex were collected from market or from the households. The samples were collected in clean plastic sample bottles, which were pre-labeled indicating the age, breed and sex, body condition, management system, and the housing type of the chicken were registered together. The samples were shipped to the faculty of Veterinary Medicine, University of Gondar and processed in the parasitological laboratory. The presence of fecal oocysts was determined using the concentration by flotation method (Bumstead *et al.*, 1991).

Post mortem examination: Post mortem examinations were conducted on few selected birds which were clinically suspected of having clinical signs of coccidiosis infection.

On these birds, after examined for the present or absence of Oocyst by fecal flotation method, proper slaughtering was done, abdominal cavity was opened to expose two intestinal parts (small and large intestines) and this part was examined for gross changes of serosal surfaces. Then the intestine was opened at different parts (duodenum, mid intestine (Jejunum/ ileum) above and below the Meckel's diverticulum and caeca) by using scissors to examine

mucosal surface according to method utilized by (Lobago *et al.* 2005).

Microscopic examination and identification of *Eimeria* species: After postmortem examination intestinal content were collected from the infected tissues (mucus of intestinal epithelium) by scraping in three segment of intestine (duodenum, mid intestine (Jejunum/ ileum) above and below the meckel's diverticulum and caeca).

In each part scraping individually 3g mucus content with 50ml of floatation fluid were sediment up to 1500rpm for 5 minute with test tube to disperse mucus content and kept in 2.5% potassium dichromate solution for the purpose of sporulation of Oocyst upto 37°C at room temperature for 2-5 days in petridish with partially open to get oxygen of Oocyst. Suspension containing sporulated Oocyst was drawn from petridish using pasture pipette. One or two drops of the suspension was placed on a microscopic slide and covered with cover slip, measure at least 25 Oocyst to determine the morphology and size of sporulated Oocysts using calibrated ocular microscope at 40x magnification as described by Long and Reid (1982).

2.6. Risk factor data collection

While collecting fecal samples from study birds, all data were record with pre-designed format (Annex

1) and enter in to computer using Microsoft excel spread sheet. The individual bird details such as sex, age, breed type, management system, body condition and the housing type of the farms were registered together.

2.7. Data Management and Analysis

All raw data generated from this study were code and enter to Microsoft office excels. The collected risk factor data were analysed using Chi-square (χ^2) test in SPSS version-20.0 statistical package. Statistical significance was set at $P < 0.05$ to determine whether there are significant differences between the parameters measured.

3. Results

Out of a total of 407 chickens examined for poultry coccidiosis, 218 were found positive. The overall prevalence of poultry coccidiosis in the study area was, therefore, 53.6%.

3.1. Risk factors

There was statistically significant difference in poultry coccidiosis between different age groups, Management system, housing system and body condition where as sex and breed was not statistically significant as shown below (Table 1).

Table 1: prevalence of poultry coccidiosis with respect to risk factors in Gondar town

Risk factors	No. Of examined	No. Of positive	prevalence	χ^2	p-value
Age				21.080	0.000
Young	183	121	66.1%		
adult	224	97	43.3%		
sex				0.151	0.698
Male	114	79	54.9%		
female	263	139	52.9%		
Breed				0.28	0.986
Local	146	79	54.1%		
Cross	120	64	53.3%		
exotic	141	75	53.2%		
Management system				17.66	0.0001
Poor	251	155	61.8%		
good	156	63	40.4%		
Housingsystem				29.430	0.000
flour	91	26	28.6%		
backyard	316	192	60.8%		
Body condition				36.271	0.000
good	217	86	39.6%		
poor	190	132	69.5%		
Overall	407	218	53.6%		

$P < 0.05$ was statistically significant where as $P > 0.05$ was not statistically significant

3.2. *Eimeria* species identified

Five species of *Eimeria* were identified from the study chickens. From the five *Eimeria* species identified, *E. necatrix*, *E. tenella* and *E. accervulina*

were the top three frequent species with prevalence of 23.5%, 22.1% and 21.1% respectively. Prevalence of *E. brunette* (15.2%) was the least frequent with prevalence of 18.4% (Table 2).

Table 2: 4. *Eimeria* species investigated in the study area and their identification characteristics

Characteristics	Species						
	<i>E.acervulin</i>	<i>E.necatrix</i>		<i>E.tenella</i>	<i>E.bruentte</i>		<i>E.maxima</i>
Location	Duodenum	Jejunum & ileum	Cecum	Cecum	Cecum	Jejunum & ileum	Jejunum & ileum
frequency	43(21.1%)	44(21.56%)	4(1.96%)	45(22.1%)	10(4.9%)	21(10.3%)	37(18.14%)
Average O. length	18.61	19.18		21.63	23.45		28.26
Average O. width	13.89	15.25		18.72	18.24		21.59
Shape index	1.3	1.26		1.56	1.28		1.31
shape	Ovoid	Oblong ovoid		Ovoid	oblong ovoid		Ovoid
Lesion	overlap whitish round plaques like colonies streaks	Ballooning, Bleeding & thickening of intestine wall.		Cloted & uncloted blood were mixed, thickening of cecal wall.	Not more appreciated than <i>E. maxima</i> and <i>E. necatrix</i>		Ballooning, hemorrhage & mucoid exudates of intestine wall

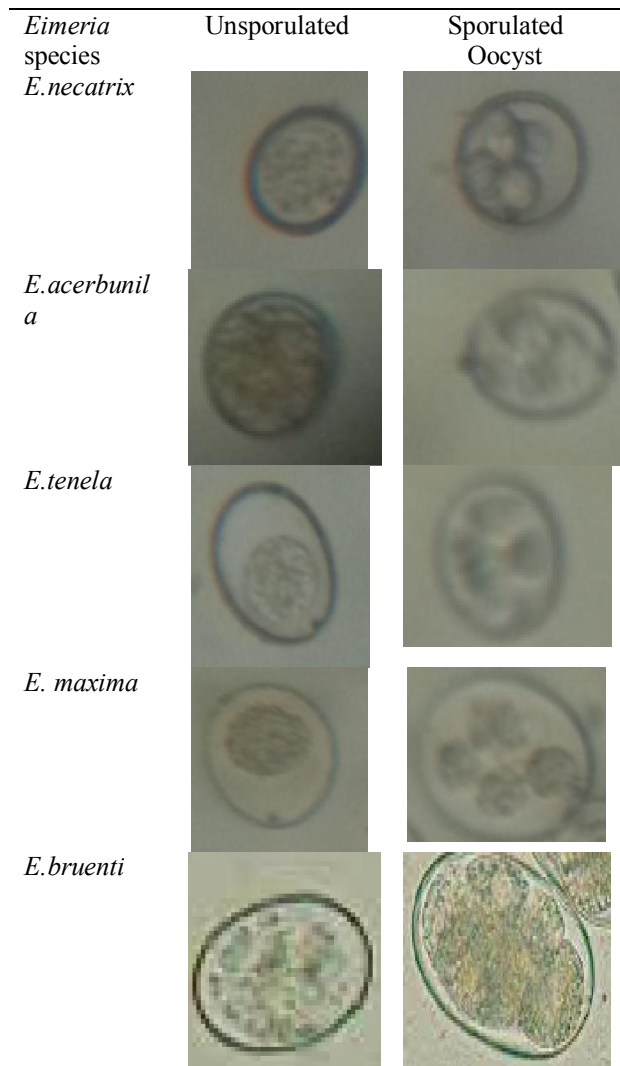


Figure 1: Sporulated and unsporulated oocyst of *Eimeria* species

4. Discussion

Coccidiosis is known to be the most prevalent and most important disease of poultry production worldwide and its prevalence and economic significance has been reviewed by different workers in different production systems. In the present study, the overall prevalence of coccidiosis was 53.6%. The result of this research was higher than the finding of Mwale and Masika (2011) who reported prevalence of 41.43% in Centane district, South Africa; and (2003) who reported a prevalence of 38.5% in Kombolcha, Ethiopia. This variation in prevalence of the disease may be due to climatic condition of coccidiainfection and differences in management systems of the farms.

Though the prevalence of coccidiosis was slightly higher in male (54.9%) than female (52.9%) chicken; this difference was not statistically significant which indicates that there was no significant natural resistance variation in relation to sex.

This study indicated that the prevalence of coccidiosis was statistically significantly higher in younger birds (66.1%) than adults (43.3%). Similar pattern of prevalence with age was reported by previous study by Hadas *et al.*, (2013) who reported 68.1% in young birds and 37.5% in adults. This could be due to in the former immunity is not well developed.

The prevalence rate of coccidiosis in the present study was not statistically significantly different in different breeds of birdstthough it is slightly high in the local breeds. However, this study disagree withthe previous report in Ethiopia by Garie *et al.*, (2008) who reported a higher prevalence of 25.10% in exotic breeds than 12.41% in local breed chickens.The slightly higher prevalence seen in local breeds in this study could be due tolocal birds are allowed to

scavenge invillages without any restriction and thus morelikely get contact with sporulated oocysts in faeces.

In this study, there was statistically significant difference in poultry coccidiosis between different housing types (Floor and Backyard) ($P=0.001$). Chickens which aremanaged in backyard production system were moreaffected (60.8%) than floor (28.6%) production systems. The present findings are higher than the findings of Lobago *et al.*, (2005) in Debre Zeit, Central Ethiopia, Ashenafi *et al.*, 2004) in central Ethiopia, 11%, 25.8% respectively due to variation in density of chickens kept in the study area, season of the year and agree with; Gari *et al.*, 2008) with the prevalence of 61.5% inTiyo District, Arsi Zone, Ethiopia.

The current study revealed that there was statically significant association between body condition and the prevalence of poultry coccidiosis ($p=0.000$). Chickenswith poor body condition (69.5%) are more affected than good body condition (39.6%) and higher than the report of (Hadaset *al.*, 2013) 43.8% in poor and lower in good body condition of 42.7% in Gondar town. This may be due to poor management practices, malnutrition and non-use of coccidiostats as preventive measures.

However, management system also was statically significant difference with the prevalence of poultry coccidiosis and higher than the 50.8% and 35.1% of poor and good management system reported by (Hadas *et al.*, 2013) in Gondar town due to poor poultry management where there is overcrowding, leaking watertroughs and accumulation of faeces are factors thatcontributed to the high prevalence rate.

The most economically important species of coccidian such as *E. Necatrix* (23.5%), *E. Tenella* (22.1%), *E. accervulina* (21.1%), *E.maxima* (18.14%) and *E.bruentti* (15.2%) were found in the study, which is in disagreement with 16.92% of the previous study reported in Ethiopia (Dereje, 2011). *Eimeria maxima*, *Eimeriaaccervulina*, *Eimerianecatrix* and *Eimeriatenella* were the most prevalent *Eimeria* species with prevalence of (36.3%), (29.5%), (18.2%) and (15.9%), respectively reported by Lobagoet *al.*, (2005) in DebreZeit, Central Ethiopia

Conclusion and Recommendations

The present study revealed high prevalence of poultry coccidiosis in Gondar town. Body condition and age of birds, and housing and management systems are important risk factors that influence coccidiosis prevalence in Gondar town. Sex and breed of birds have no association with coccidiosis. *Eimeria* species such as *E. necatrix*, *E. tenella*, *E. accervulina*, *E.maxima*, and *E.bruentti*, were the most important

species that cause coccidiosis and *E. necatrix* and *E. Tenella* are most pathogenic species in the study area.

Based on the above findings the following recommendations are forwarded:

✚ Biosecurity practices should be given prime attention in the prevention and control of coccidiosis so as to reduce the high prevalence of coccidiosis observed in this study.

✚ Management procedures which limit contamination of litter should be paid high emphasis and litter should always be kept dry.

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