Study on the Prevalence and Risk Factors of Poultry Coccidiosis in Mekelle Town, North Ethiopia

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**Abstract:** A cross sectional study was conducted from November 2015 to April 2016 in poultry farms in Mekelle town, to estimate the prevalence of poultry coccidiosis and associated risk factors in the study area on Bovans brown and Sasso T44 chicken breeds. Fecal samples were taken from selected farms a total of 384 chickens and examined in Mekelle University College of veterinary medicine parasitological diagnostic laboratory. Floatation and McMaster Oocysts counting techniques were performed for qualitative and quantitative examination of coccidian Oocysts, respectively. The statically data analysis revealed that out of the 384 chickens examined, 78 (20.3%) chickens were found positive for coccidian Oocyst. The prevalence of coccidiosis was relatively higher in young (26.1%) than adult (17.2%) age groups. Statistically significant difference (P <0.05) was noted between young and adult age groups. However, there were no significant differences between sex and breed groups of chickens (P>0.05). In conclusion, the present study showed that coccidiosis is an important disease of poultry in the study area and further strategy needs for intervention through awareness creation among poultry farms, veterinarians and local society to control and prevent the disease and reduce the economic loss due to coccidiosis.

**Key words:** Bovans Brown · Coccidiosis · Mekelle · Poultry · Prevalence · Sasso T44

**INTRODUCTION**

Poultry is the largest livestock species worldwide. The world poultry population has been estimated to be about 16.2 billion, of which 71.6 % were found in developing countries, producing 67,718,544 metric tons of chicken meat and 57,861,747 metric tons of hen eggs per annum [1]. In Africa, village poultry contributes over 70% of poultry products and 20% of animal protein intake. In East Africa, over 80% of human population lives in rural areas and over 75% of these households keep indigenous chickens and Ethiopia is not exceptional from this situation [2].

Ethiopia has large population of chickens estimated to be 48.89 million with native chickens of non-descriptive breed, hybrid of chickens and exotic breed of chickens mainly kept in urban and peril-urban areas representing 96.6%, 0.55% and 2.8%, respectively [3]. From the total population of chicken in Ethiopia, 99 % are raised under the traditional back yard management system, while 1 % is under intensive management system [4].Commercial poultry consists in exotic breeds selected for their capacity in producing egg and meat; and because of this selection, these breeds are much more susceptible to diseases than the traditional backyard poultry [5].

Three types of poultry production systems are identified in Ethiopia; these are backyard poultry production system, small scale and large-scale intensive poultry production systems [6]. The low productivity of poultry can be partly attributed to a range of factors such as sub-optimal management, lack of supplementary feed, low genetic potential, high morbidity and mortality rate due to various diseases. Similarly in the modern commercial poultry industry, increased disease and infections by enteric pathogens are common due to intense raring systems. In Ethiopia, poultry production has been hindered by different prevalent diseases from which Newcastle disease, coccidiosis, salmonellosis and chronic respiratory disease are the important one [7].

Poultry coccidiosis is one of these diseases causing significant poultry losses in Ethiopia [8]. It is caused by the intracellular protozoa parasite of *Eimeria* species in
the genus *Eimeria* family *Eimeridae* order *Eucoccidiorida* and phylum *Apicomplexa* [9]. Infections caused by coccidian parasites have had a major economic impact on the commercial broiler industry in the past several decades. It remains as the most economically significant parasitic infection of the poultry industry, worldwide. It is endemic in most of the tropical and subtropical regions where ecological and management conditions favor an all year-round development and propagation of the causal agent [10]. Infection by coccidial sufficient numbers to produce clinical manifestations of disease is called coccidiosis. A light infection that does not result in demonstrable clinical effects is referred to as coccidiasis [11, 12]. Seven species of *Eimeria* (*E. acervulina, E. brunetti, E. maxima, E. mitis, E. necatrix, E. praecox* and *E. tenella*) are recognized as infecting chickens. In Ethiopia, *E.necatrix, E.maxima and E.tenella* are endemic in all parts of the poultry and affect many young growing chickens [8].

The occurrence of clinical coccidiosis is directly related to the number of oocysts ingested by poultry at one time, the pathogenicity of the *Eimeria* species, the age of the infected chicken and the management system [13]. The first and most frequent symptoms is at the beginning yellow diarrhea then become depressed, have ruffled feathers, the wings droop and tend to huddle together [14].Coccidiosis still continues to be one of the most expensive and common diseases poultry in spite of advances made in prevention and control through chemotherapy, management, nutrition and genetic improvement [15, 16].

World-wide losses to poultry industry due to coccidiosis have been estimated about 800 million $ annually [17]. The major reasons for the economic loss include loss of egg and meat production, veterinary drugs and inputs, managements and litter costs [18]. Quantitative losses due to coccidiosis in Ethiopia are not well documented, but Kinung’hi *et al.* [19] has reported that coccidiosis contributes to 8.4% loss in profit in large-scale farms and 11.86% loss in profit in small-scale farms.. Regarding the disease poultry coccidiosis in Mekelle poultry farms information is not available as no researcher has been done particularly on exotic (Bovans brown and Sasso T44) chickens. The prevalence of the disease and associated risk factors in Mekelle town were not well addressed yet.

Therefore, the objectives of this study were:

- To identify the associated risk factors of coccidiosis in poultry farms in mekelle town.

MATERIALS AND METHODS

**Study Area:** A cross sectional study was conducted from November 2015 to April 2016 in poultry farms in Mekelle town. The town is located North part of Ethiopia at around 783 km away from Addis Ababa. It is located 783 km North of Addis Ababa at 39° 29’ E and 13° 30’ N at an altitude of 2000 m a. s. l (meter at sea level). The climate of the study area conforms to that of Ethiopian Highlands. The mean annual rainfall is 619mm, which is bimodal with short rainy seasons occurring from March to May and from mid-September to February. The annual minimum and maximum temperature is 11.8°C and 29.9°C, respectively. The region covers an area of 54,548.32km². the livestock resource of the region consist of 3,596,649 cattle, 2,570,833 poultry, 1,646,752goats, 1,064,501 sheep, 364,940 equines and 13,661 camels representing nearly 10% of the livestock population of the country [20].

**Study Population:** The study was conducted on two exotic chicken breeds (Bovans brown and Sasso T44) layers and dual purpose respectively from selected farms. Chickens were selected according to their age, sex and breeds as to be examined for the presence or absence of coccidian infestation and coccidiosis. Chickens were kept under intensive husbandry system. The age was conveniently subdivided young (2-8 weeks) of age and adult above 8 weeks of age [21].

**Sample Size Determination:** Since the prevalence of coccidiosis in chicken in mekelle town poultry farms has not been reported, 50% expected prevalence rate was used. In addition, 95% confidence interval and 5% desired absolute precision [22].

This is calculated by using the following formula:

\[
n = \frac{1.96^2 \times \bar{P} \times (1-\bar{P})}{d^2}
\]

where

- \(n\) = required sample size
- \(\bar{P}\) = expected prevalence
- \(d\) = desired absolute precision (0.05)

As a result, 384 study populations will be selected.
Study Design and Methods: A cross sectional study was done and both qualitative (Floatation technique) and quantitative (McMaster Oocysts counting technique) fecal examinations were conducted. The fecal samples were collected from fresh dropping and put in plastic bottles from each chicken then labeling by using marker and brought to Mekelle University College of veterinary medicine parasitological diagnostic laboratory for examination.

During sampling age, breed and sex were recorded. Oocysts in each fecal sample of chicken were detected by using flotation technique using saturated Sodium Chloride solution and counting of oocysts was done by using McMaster counting technique and was expressed as per gram of feces [12]. Simple random sampling techniques was used to select an individual chickens.

Data Analysis: The raw data were entered and manage in Microsoft Excel worksheet and descriptive statistic was utilized to summarize the data. The point prevalence was calculated for all data by dividing positive samples by total number of examined samples and multiplied by hundred. The association between the prevalence of the disease and risk factors was assessed by Chi-square A statically significant association between variables was considered to exist if the computed p value as less than 0.05 [9]. All statistical analyses were done using SPSS statistical software version 20.

RESULTS

Floatation Technique Based Result: A total of 384 fecal samples were examined from exotic chickens reared in Mekelle town poultry farms to determine the presence of oocysts. Out of the total samples, 78 (20.3%) were found to be positive for coccidian oocysts of the Eimeria species (Table 1).

According to the statistical data analysis, there was no significance difference in the infection level between the two sex groups (P > 0.05). But the prevalence of coccidiosis was higher in males (21.4%) than in females (19.9%) as indicated in the above (Table 1). Even though the prevalence of coccidiosis was higher in young (26.1%) than in adult (17.2%), but the infection was statistically significant between the two age groups (P < 0.05) as indicated in (Table 1). The prevalence of coccidiosis was higher in Sasso T44 breed (20.6%) than in Bovans brown (19.9%), the infection was statistically not significance difference between the two exotic breed groups (Bovans brown and Sasso T44) (P > 0.05).

Majority of the chickens were female (69.5%) and adult (65.1%) and the proportion of both breeds were (43.2%, 56.8%) Bovans brown and Sasso T44 respectively (Table 2).

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Number of examined</th>
<th>Number of positive</th>
<th>Prevalence %</th>
<th>Chi-square (x²)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>267</td>
<td>53</td>
<td>19.9</td>
<td>0.116</td>
<td>0.734</td>
</tr>
<tr>
<td>Male</td>
<td>117</td>
<td>25</td>
<td>21.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>78</td>
<td>20.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td>134</td>
<td>35</td>
<td>26.1</td>
<td>4.288</td>
<td>0.038</td>
</tr>
<tr>
<td>Adult</td>
<td>250</td>
<td>43</td>
<td>17.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>78</td>
<td>20.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bovans brown</td>
<td>166</td>
<td>33</td>
<td>19.9</td>
<td>0.034</td>
<td>0.854</td>
</tr>
<tr>
<td>Sasso T44</td>
<td>218</td>
<td>45</td>
<td>20.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>78</td>
<td>20.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Characteristics of the chickens examined for coccidiosis

<table>
<thead>
<tr>
<th>Characteristics of chickens</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td>134</td>
<td>34.9%</td>
</tr>
<tr>
<td>Adult</td>
<td>250</td>
<td>65.1%</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>100%</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>267</td>
<td>69.5%</td>
</tr>
<tr>
<td>Male</td>
<td>117</td>
<td>30.5%</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>100%</td>
</tr>
<tr>
<td>Breed</td>
<td></td>
<td></td>
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<tr>
<td>Bovans brown</td>
<td>166</td>
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<tr>
<td>Sasso T44</td>
<td>218</td>
<td>56.8%</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>100%</td>
</tr>
</tbody>
</table>
McMaster Oocysts Counting Based Result: All oocysts positive samples (78) were examined by McMaster oocysts counting technique to quantify the oocysts burden and determine the severity of infestation. Accordingly, all samples were found to be infested with oocysts number less than 10,000 OPG and hence, the infection level was rated as light infestation.

DISCUSSION

Coccidiosis is known to be the most prevalent and most important disease of poultry production all over the world. It is a type of protozoan parasitic disease caused by different *Eimeria* species in poultry. It is also considered as an intestinal disease affecting the small intestine and cecum. From the current study of coccidiosis, the overall prevalence of coccidiosis of chicken in the study area was 20.3%. This result agreed with the findings of Yohannes *et al.* [23] (17.5 %), Ashenafi *et al.* [24] (25.8%), Abadi *et al.* [25] (22.3%) and *et al.* [18] (22.58%), at Tigray, Addis Ababa, Kombelcha and Arsi zone, respectively.

Moreover this result was also in line with the finding of Diriba *et al.*[21] how reported a prevalence of (20.57%) in poultry farms in and around Ambo town, Western Ethiopia. However, the present results disagree with the finding of Ermias [26] (56.3%), Migbaru and Abadi.[27] (42.7%), Netsanet[28] (38.5%), Mwale and Masika[29] (41.43%) and Hadas[30] (43%), in Addis Ababa, Dire Dawa area, Kombolcha (Ethiopia), Centane district (South Africa) and Gondar town respectively. This variation in prevalence of the disease may be due to epidemiology of coccidian infection and differences in management systems of different poultry farms.

As the current study revealed that the prevalence of coccidiosis was almost similar in both female (19.9%) and male (21.6%) sex groups of chickens. But, it was not statistically significant (P>0.05). This result agreed with the report of previous studies Hadas *et al.* [30] and Migbaru and Abadi[27] Who stated that there was a spastically significant between the two exotic breeds of chickens (P < 0.05). Thus, no significant natural resistance variation was observed between Bovans brown and Sasso T44 breeds to coccidiosis under natural infection [32]. This may be due to equal chance of exposure to the coccidial infection as well as both breeds were kept under the same management practice.

The result of current study revealed that the level of infection at the study area was indicated as light infection (<10,000 OPG). This result disagrees with the *Yohannes et al.*[23] finding, who reported severe infestation (>15,000 OPG) and medium infestation (>10,000 OPG) infection of coccidiosis in Tigray, North Ethiopia. This difference may be due to epidemiological and management differences in different farms.

CONCLUSION

The result of the current study showed that different risk factors have contributed for the occurrence of poultry coccidiosis infection in the study sites. From these sexes,
age and breeds are the most common factors. Coccidiosis is almost similar prevalent between Bovans brown and Sasso T44 breeds in Mekelle poultry farms. In conclusion, despite the reduction in the prevalence of coccidiosis in the present study, coccidiosis is a major burden to poultry producers and veterinary health professionals. Coccidiosis is highly prevalent between young and adult age groups in Mekelle town poultry farms and to be one of the main risk factors for the prevalence of coccidiosis in this area. The occurrence of coccidiosis in different age categories has statistically significant but in sex and breed categories were not statistically significant differences. Floatation and McMaster Egg counting techniques were performed for qualitative and quantitative studies respectively. The farms have different management practice and biosecurity measures. Also chickens were overcrowded in the floor type of house and the local society has no awareness to the prevalence of coccidiosis in that area. Generally, poultry coccidiosis is still one of the important health problems in the study area.

Therefore, based on the above conclusion, the following recommendations are forwarded:

- Biosecurity practices should be a primary concept in the prevention and control of coccidiosis.
- The farms should have good management practices like dry and clean litter, clean feeders and drinkers, good ventilation and hygienic conditions.
- The farms should avoid overcrowding and mixing different ages of chickens in the same house.
- Awareness should be created among the society regarding to the occurrence of the disease.

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