Prevalence of Coccidiosis among Exotic Breed Chickens in Adama Town, Ethiopia

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Abstract: Coccidiosis is the most important parasitic disease of poultry and it remains a major burden to poultry producers as well as resulting in significant economic losses worldwide. A cross sectional study was conducted in Adama town between the periods of November 2013 to May 2014 with the aims to determine the prevalence of coccidiosis and assess risk factors for the occurrence of coccidiosis among chickens that are kept in deep litter. This study involved post mortem, mucosal scraping and fecal floatation examination to evaluate the prevalence of coccidiosis and to assess the predisposing factors. The overall prevalence of coccidiosis was found to be 56.3% (95% CI: 51.3-61.3) in fecal floatation and mucosal scraping techniques. The prevalence of coccidiosis was found to be 53.8% (95% CI: 48.6-59.1) and 86.7% (95% CI: 69.3-96.2) in fecal floatation and dead poultry respectively. The prevalence of poultry coccidiosis was known to be 65.4% (95% CI: 58.2-72.2) and 41.5% (95% CI: 34.1-49.1) among young and adult poultry respectively. The prevalence of coccidiosis was confirmed to be 38.4% (95% CI: 28.1-49.4), 44.4% (95% CI: 34.5-55.3) and 65.4% (95% CI: 58.2-72.2) in White Leg Horn, Barred Plymouth Rocks and Cross Bovane Breed poultry breeds respectively. The prevalence of coccidiosis was proved to be significantly higher in young than adult (P<0.05) chickens. However, no statistically significant difference (p>0.05) was observed between sexes and among breeds. Hence, coccidiosis was proved to be a problem of mortality among poultry farms in Adama town. Hence, management system of these deep litter farms should be improved and chickens’ should be managed separately based on difference in their sex and age.

Key words: Prevalence • Coccidiosis • Poultry • Adama • Ethiopia

INTRODUCTION

Poultry constitutes an important component of agricultural and household economy in the developing world and play important role to enable the landless poor farmers move out of poverty. The world poultry population has been estimated to be about 16.2 billion, with 71.6 % in developing countries, producing 67,718,544 metric tons of chicken meat and 57,861,747 metric tons of hen eggs [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 live in rural areas and over 75% of these households keep indigenous chickens and Ethiopia is not exception to this situation [2].

Ethiopia has large population of chicken, estimated to be 42 million. Recent estimates put the poultry population in Ethiopia at around 40.6 million with native chicken of none descriptive breeds representing 96.6%, hybrid chicken 0.55% and exotic breeds of chickens mainly kept in urban and peri-urban areas 2.84% [3].

Several factors have been suggested for the low production characteristics of free-range village chickens. The system is characterized by low input and low output, with minimal management interventions, feed supplementation, housing and disease control. This kind of production by itself is a limiting factor to sound economic and sustainable production. The low input might be, however, a result of the high risk due to high mortalities experienced in village poultry. Thus, the
potential of the free-range chicken production has not been exploited. Therefore, if any success is to be achieved in improvement for free-ranging chicken production, it will inevitably depend on the successful control of major poultry diseases [4].

However, the poultry production in Ethiopia has been hindered by different prevalent disease among which important ones are Newcastle disease, coccidiosis, salmonellosis and chronic respiratory disease [5].

Coccidiosis in chickens is one of the major problems of poultry industry that is caused by protozoan parasites of genus *Eimeria*. It is considered as one of the most economically important diseases of domestic poultry that is responsible for significant economic losses to the worldwide poultry industry. It is caused by one or several of seven *Eimeria* species infecting chickens. These species differ in their localization in the gut and in their ability to induce morbidity and mortality. This parasitic infection occurs in the epithelial cells of the intestine, despite the advances in nutrition, chemotherapy, management and genetics. Most *Eimeria* species affect birds between 3 and 18 weeks of age and can cause high mortality in young chickens [6].

In Ethiopia, the study conducted by [7] showed that coccidiosis contributes to 8.4 and 11.86% losses in profit in large and small-scale farms respectively. Losses due to mortality following a severe outbreak may be devastating and incidence rates as high as 80% were sometimes observed in the country [8]. The prevalence of the disease and associated risk factors in and around Adama town were not well addressed yet. Therefore, the objectives of this study were to determine the prevalence of avian coccidiosis in poultry farms and its association with different risk factors in the area.

**MATERIALS AND METHODS**

**Study Area and Study Period:** The study was conducted in Adama town, East Shewa Zone, Oromia Regional State during the periods of November 2013 to May 2014. Adama town is located 99 km East of Addis Ababa. Geographically Adama town is located at 8°44’ North latitude and 39°04’ East longitude. The area has an altitude ranging east part between 1400-2300 m above sea level in central rift valley of Ethiopia. The climatic condition of the area is dominant woina-dega and with some kola. The area receives an annual range of rainfall from 600-1150 mm and the temperature ranges between 12-33°C. Adama town (district) has livestock population of 96,000 bovine, 48,970 caprine, 40,500 ovine, 39,010 equine and 143,743 poultry [3].

**Study Animals:** The study was conducted among intensive poultry farms in Adama town that are owned by private enterprenuers. The study animals were exotic breeds of poultry and they were grouped into sex (male and female), breeds (Brown Bovane parent stock, Barred Plymouth Rocks (dual purpose breeds ) and Cross Bovane Breed (commercial breeds)) and ages as young (3-18 weeks) and adult (above 18 weeks of age) as describe by [6]. The chickens used in this study were those reared entirely in deep litter management which owned by private enterprenuer and merchants. The principle is that the health status of chickens taken from farms could reasonably reflect the actual health status of the population from which they are taken.

**Sample Size Determination:** Since the prevalence of coccidiosis in chicken in Adama town, poultry farm has not been reported, 50% expected prevalence was used. In addition, 95% confidence interval and 5% desired absolute precision also used Thrusfield [9]. Hence the sample size was calculated by using the following formula.

\[ n = \frac{(1.96)^2 \cdot P_{exp} \cdot (1 - P_{exp})}{d^2} \]

where, \( n \) = sample size required, \( P_{exp} \) = expected prevalence, \( d \) = desired absolute precision Therefore, the total sample size was calculated to be 384. In this study, 394 samples were collected, among them 364 fecal samples were collected randomly from poultry farms and the remaining 30 mucosal scraping sample were taken after postmortem was done. Samples were submitted to Assela Regional Veterinary Laboratory in Assela and to Adama Veterinary clinic laboratory in Adama for subsequent examination.

**Study Design and Sample Collection:** A cross sectional study was conducted to determine the prevalence of poultry coccidiosis. Faecal floatation technique and mucosal scraping examinations were used to determine the presence of coccidiosis. Fecal samples (3 gram) were collected via plastic bottle (universal bottle) and swab samples directly from rectum or immediately after defecation and preserved in 2% potassium dichromate.
During sampling age, breed and sex of the chickens were recorded. Oocysts in each faecal sample of chicken were detected by using flotation technique using saturated sodium chloride solution as adopted for coprological examination as describe by Rehman et al., [10].

Study Methodology
Fecal Floatation Examination: A large number of different procedures are available for demonstrating coccidia oocysts in poultry faeces. The most widely used principle for concentration of parasite oocysts is flotation. Coccidia oocysts have a specific gravity, which is lower than that of plant residues in the faeces, the oocysts may be separated from other faecal particles by mixing the faeces with a fluid (saturated NaCl + glucose) in which the oocysts float these procedures include test tube flotation and simple flotation [11].

Postmortem Examination: All dead and sick chickens were opened to expose their abdominal cavity and viscera. The abdominal cavity and viscera were thoroughly examined for gross pathological changes. The content and segment of the intestine was examined after being rinsed in running tap water to remove trace of blood. The small intestines and large intestines were examined for gross changes of serosal surfaces. Using scissor, the intestine were opened at different position i.e. duodenum, mid intestine above and below the meckel’s diverticulum, the lower intestine and the caeca according to method utilized by Zander and Mallinson [12].

Mucosal Scraping Examination: Mucosal scrapings for microscopic examination of development stage of coccidia were taken from segment of intestine with lesions. They were placed on microscopic slides, diluted with drop of tap water, mixed thoroughly and covered with cover slip and examined under light microscope according to the procedure describe by [13].

Statistical Analysis: Computation of descriptive statistics was conducted using SPSS version 20. Descriptive statistics such as percentages, proportions and frequency distributions were applied to compute some of the data. The prevalence of coccidiosis was calculated by dividing the number of chickens harboring a given parasite by the number of chickens examined (i.e. the proportion of positive results among tested chickens). Pearson’s chi-square ($\chi^2$) to measure association between prevalence of the poultry coccidiosis with the age, sex and breed of chickens was used as the statistical tool. Confidence level was held at 95% and statistical analysis for the difference in prevalence of coccidiosis among risk factors were considered significant when the p-value was less than 0.05 ($P<0.05$).

RESULTS

The Overall Prevalence of Coccidiosis: Out of 394 poultry samples examined, 222 samples were found to be positive for Eimeria species oocysts. Hence, the overall prevalence of poultry coccidiosis was found to be 56.3% among intensive farms in Adama town, Ethiopia (Table 1).

Out of the 394 samples examined (364 fecal and 30 mucosal scraping samples), 196 (53.8%) and 26 (86.7%) were found to be positive for coccidiosis respectively and the overall prevalence of poultry coccidiosis in intensive farms were confirmed to be 56.3%. The prevalence of poultry coccidiosis was known to be higher in mucosal scraping sample (86.7%) compared to fecal floatation sample (53.8%). Statistical analysis of the data showed that there was statistically significant difference ($p<0.05$) in the prevalence of coccidiosis between sampling techniques.

Out of 364 faecal samples examined, 196 samples were found to be positive for coccidiosis. The specific prevalence of of coccidiosis was known to be 65.4% and 42.8% among young and adult poultry respectively. The prevalence of poultry coccidiosis was higher in young poultry as compared to adult poultry and there was statistically significance difference ($p<0.05$) on the prevalence of coccidiosis between ages of chickens.

A total of 364 faecal samples (White Leg Horn=86, Barred Plymouth Rocks=90 and Cross Bovane Breed=188) were examined. The breed specific prevalence of coccidiosis was confirmed to be 38.4%, 44.4% and 65.4% in White Leg Horn, Barred Plymouth Rocks and Cross Bovane Breed respectively. Statistical analysis of the data showed that there was no statistically significance difference ($p>0.05$) in the prevalence of coccidiosis among the breeds of poultry (Table 2).

The prevalence of poultry coccidiosis was higher in females (56.6%) than males (38.2%). But there was no statistically significant difference ($p>0.05$) in the prevalence of coccidiosis between sexes of poultry.
Table 1: Prevalence of coccidiosis between fecal and mucosal samples

<table>
<thead>
<tr>
<th>Sample Examined</th>
<th>Examined</th>
<th>Positive</th>
<th>Prevalence (%)</th>
<th>$\chi^2$</th>
<th>p - value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecal</td>
<td>364</td>
<td>196</td>
<td>53.8%</td>
<td>12.137</td>
<td>0.000</td>
<td>48.6-59.1%</td>
</tr>
<tr>
<td>Mucosal scraping</td>
<td>30</td>
<td>26</td>
<td>86.7%</td>
<td></td>
<td></td>
<td>69.3-96.2%</td>
</tr>
<tr>
<td>Total</td>
<td>394</td>
<td>222</td>
<td>56.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: The Prevalence of Coccidiosis among Age, Breed and Sex

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Examined</th>
<th>Positive</th>
<th>Prev. (%) $\chi^2$</th>
<th>P - value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>188</td>
<td>123</td>
<td>65.4% 24.8</td>
<td>0.003</td>
<td>58.2-72.2%</td>
</tr>
<tr>
<td>Adult</td>
<td>176</td>
<td>73</td>
<td>41.5%</td>
<td></td>
<td>34.1-49.1%</td>
</tr>
<tr>
<td>Breed</td>
<td>WLH</td>
<td>86</td>
<td>33</td>
<td>38.4% 21.9</td>
<td>0.439</td>
</tr>
<tr>
<td>BPR</td>
<td>90</td>
<td>40</td>
<td>44.4%</td>
<td></td>
<td>34-55.3%</td>
</tr>
<tr>
<td>CBB</td>
<td>188</td>
<td>123</td>
<td>65.4%</td>
<td></td>
<td>58.2-72.2%</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>55</td>
<td>21</td>
<td>38.2% 8.57</td>
<td>0.590</td>
</tr>
<tr>
<td>Female</td>
<td>309</td>
<td>175</td>
<td>56.6%</td>
<td></td>
<td>50.9-62.2%</td>
</tr>
</tbody>
</table>

WLH= White Leg Horn, BPR= Barred Plymouth Rocksm, CBB= Cross Bovane Breed

**DISCUSSION**

The present study revealed an overall prevalence of 56.3% coccidiosis among poultry that are kept in intensive farms in Adama town, Ethiopia. This high prevalence might be attributed to risk factors (ages, sexes and breeds), high stocking density and absence of intervention between flock resulting in high contamination rate of the poultry house with oocysts of *Eimeria* and lack of regular disposal of litter from the farm. The result of the current study agree with the report of Fessesswork [14] who recorded 50.8% prevalence of coccidiosis in deep litter poultry production system in Debre zeit and Nematollahi *et al.* [15] who recorded 55.96% prevalence of coccidiosis in broiler farms in Tabriz. Our result disagrees with the finding of Getachew *et al.* [8] who reported prevalence of 38.5%. This variation in prevalence of the poultry coccidiosis may be due to drug resistance of coccidian infection and differences in management systems of the farms.

In this study 53.8% of prevalence of coccidiosis was recorded from subclinical coccidiosis via fecal floatation technique and 86.7% was recorded from dead and sick clinical coccidiosis via mucosal scraping. This study revealed a statistically significant difference ($P<0.05$) between sample techniques. This significance difference might be attributed to the fact that mucosal examination is more sensitive than fecal floatation and there could be absence of expelling oocysts with feces. The mucosal scraping result (86.7%) in this study was in agreement with the report of Alamargot [16] who reported 80% prevalence in Debre-zeit. The present finding was relatively higher than that reported by Dinka and Hailu [17] who reported 71.7% in Debre-Zeit agricultural research center poultry farm.

The current study revealed that the prevalence of coccidiosis was higher in young (65.4%) than adult (41.5%). Statistical analysis of the data showed the presence of statistically significant difference ($P<0.05$) in the prevalence of coccidiosis among poultry between ages. This finding agrees with previous reports that coccidiosis is the most common to birds under intensive management especially those on deep litter due to relatively higher oocysts accumulation in the deep litter. The present result disagrees with the record of Getachew *et al.* [8] who reported the prevalence of clinical coccidiosis in adult parent stocks to be significantly higher than the young. The highest prevalence of coccidiosis among young chicks could be justified by the fact that young chickens are not fully immunized and can experience great mortality in coccidiosis outbreak.

This study showed 38.4%, 44.4% and 65.4% prevalence of coccidiosis among White Leg Horn, Barred Plymouth Rocksm and Cross Bovane Breeds respectively. The occurrence of coccidiosis in Cross Bovane Breeds was higher than White Leg Horn and Barred Plymouth Rocksm. The difference of variation of prevalence among these exotic breeds may be due to the variety of intervention and management system. There was not statistically significant difference ($P>0.05$) in prevalence of coccidiosis among breeds. However, the variation in the prevalence of coccidiosis in this study between breeds may be due to the effects of environmental factors in spite of the genotypic factor in which three genotypes were exotic breeds. Thus, no significant natural resistance variation was observed between White Leg Horn, Barred Plymouth Rocksm and Cross Bovane Breeds to coccidiosis under natural infection [19, 18].
The prevalence of coccidiosis was found to be higher in female (56.6%) than male (38.5%) poultry. The higher prevalence of coccidiosis among females might be attributed to stress during egg production. Statistical analysis of the data indicated that there was no statistically significant difference (p> 0.05) in the prevalence of coccidiosis between sexes.

CONCLUSION

In present study coccidiosis was found to be highly prevalent in Adama intensive poultry farms. The study illustrate that coccidiosis is still the most important parasitic disease of poultry and poultry coccidiosis remains a major burden to poultry producers in farms. The high prevalence infection observed in this study may suggest the presence of favorable condition for biology, transmission of this pathogen. In addition the high prevalence of coccidiosis is related with management problem, limitation of interventions for disease and limitation of managerial knowledge about the diseases. The high prevalence of coccidiosis in the study area together with the low awareness of chicken producers about the health care of chickens may pose devastating health problems to the chickens and economic losses to poultry production sector. Hence, management system of these deep litter farms should be improved and chickens’ should be managed separately based on difference in their sex and age.

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REFERENCES