Epidemiology and Risk Factors of Coccidiosis in Broilers: Investigating the Prevalence, Distribution, and Risk Factors Associated with Coccidiosis Outbreaks in Broiler Production

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ABSTRACT

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Background: Coccidiosis is highly prevalent parasitic disease posing significant challenges to broiler production worldwide.

Objectives: This study aimed to investigate the prevalence, distribution, and risk factors associated with coccidiosis outbreaks in broiler production systems.

Methods: A cross-sectional study design was employed, and a total of 15 flocks, comprising 16,300 birds, were examined.

Results: The overall prevalence rate of coccidiosis was found to be 66.7%. Among individual farms, Farm 1 reported a prevalence rate of 60.0%, Farm 2 had a rate of 50.0%, and Farm 3 exhibited the highest incidence at 83.3%. The specific species distribution within the positive flocks varied across farms. Farm 1 showed a mixed infection involving Eimeria tenella and Eimeria maxima, while Eimeria necatrix and Eimeria acervulina were found in Farm 2. Farm 3 exhibited a more diverse species distribution, including Eimeria necatrix, Eimeria tenella, Eimeria acervulina, and Eimeria maxima. Furthermore, this study identified several risk factors associated with coccidiosis outbreaks in broiler production. The analysis revealed that larger farm size, inadequate biosecurity measures, and poor feed quality were significantly associated with an increased risk of coccidiosis outbreaks.

Conclusion: These findings provide valuable insights into the epidemiology of coccidiosis in broiler production and the factors influencing its occurrence. By targeting the prevalent Eimeria species and addressing the identified risk factors, poultry producers can minimize the impact of coccidiosis on broiler health, welfare, and economic performance.

Keywords: Broilers; Coccidiosis; Eimeria species; Farming practices; Feeding of poultry.

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INTRODUCTION

Coccidiosis is a prevalent and economically significant parasitic disease affecting broiler production worldwide. The protozoan Eimeria, that invade the intestinal lining of birds, leading to impaired nutrient absorption, reduced growth rates, and increased mortality. The disease poses significant challenges to the poultry industry, resulting in substantial economic losses due to decreased productivity and the need for costly control measures.

The prevalence of coccidiosis can vary greatly depending on geographical location, management practices, and the specific Eimeria species involved. Broiler production systems, with their high stocking densities and intensive management practices, provide an environment conducive to the transmission and spread of the disease. Moreover, emergence of drug-resistant strains of Eimeria further complicates control of coccidiosis in broilers.

Risk factors associated with coccidiosis outbreaks in broilers can be multifactorial, encompassing various aspects of production, including biosecurity measures, litter management, vaccination programs, and feed quality. Environmental factors such as temperature, humidity, and the presence of oocysts in the poultry house also play a significant role in disease transmission and development. Understanding the epidemiology and risk factors of coccidiosis in broilers is vital for mitigating the negative consequences of the disease. This study will provide valuable information on the prevalence, distribution, and key factors contributing to coccidiosis outbreaks, paving the way for improved management practices and control measures in broiler production systems.

Understanding the epidemiology and risk factors associated with coccidiosis outbreaks in broiler production is crucial for effective disease management and prevention strategies. This study aims to investigate the prevalence, distribution, and risk factors contributing to coccidiosis outbreaks in broilers, shedding light on key factors that influence disease occurrence and severity. By investigating the prevalence, distribution, and risk factors associated with coccidiosis outbreaks in broiler production, this study aims to provide valuable insights that can contribute to the development of effective preventive measures and control strategies. The findings of this research would assist poultry producers, veterinarians, and industry stakeholders in implementing targeted interventions to reduce the impact of coccidiosis on broiler health, welfare, and economic performance.

MATERIAL AND METHODS

Study Design

A cross-sectional study instigated epidemiology and risk factors associated with coccidiosis outbreaks in broiler production.

Sample Size Determination

Sample size of 384 was determined based on desired level of precision, expected prevalence of coccidiosis (50%), and the confidence level (95%). A sample size calculation was performed using appropriate statistical methods to ensure sufficient power to detect meaningful associations. This flock of 384 birds was maintained at National Agriculture Research...
Council, Islamabad during 2022-23 and additionally the flocks in different regions of Rawalpindi and Islamabad were visited to collect the data in diversity.

Data Collection

Data collection involved a combination of direct observations and laboratory analyses. Additionally field visits were conducted to collect information on farm characteristics, management practices, and biosecurity measures. Individual bird data, including age, weight, and signs of coccidiosis, were recorded during farm visits. Environmental samples, such as litter, feed, and water, were collected for laboratory analysis.

Laboratory Analysis

Fecal samples were collected from broilers within the flock to determine the presence and species of Eimeria oocysts. The fecal samples were processed using standard parasitological techniques, such as flotation and microscopy. Eimeria oocysts were identified and counted to assess the level of infection and species distribution within each flock.

Data Analysis

Descriptive statistics were used to summarize the prevalence and distribution of coccidiosis outbreaks in the study population. Statistical analyses, such as Chi-square tests or ANOVA, were performed to identify risk factors associated with coccidiosis outbreaks. Risk factors considered for analysis included farm characteristics, management practices, biosecurity measures, and environmental factors. Associations between potential risk factors and coccidiosis outbreaks were assessed, taking into account confounding variables and controlling for potential biases.

Limitations

The study was subject to certain limitations, such as the reliance on self-reported data and the potential for selection bias in farm sampling. The generalizability of the findings may be limited to the specific geographic area or production system under investigation.

RESULTS

Prevalence and species distribution of coccidiosis in broiler flocks from various farms. The study investigated coccidiosis outbreaks in broiler production. NARC Farm, with a single flock and 384 birds examined, did not report any positive flocks, resulting in a prevalence rate of 0.0% (p<0.05). Farm 1, consisting of five flocks and 5000 birds examined, reported three positive flocks, indicating a prevalence rate of 60.0%. This suggests a moderate occurrence of coccidiosis in Farm 1. Similarly, Farm 2, with four flocks and 4800 birds examined, reported two positive flocks, resulting in a prevalence rate of 50.0%. This farm also experienced a moderate level of coccidiosis outbreaks. Farm 3 had the highest number of flocks examined, totaling six flocks and 6500 birds. Among these, five flocks tested positive for coccidiosis, leading to a prevalence rate of 83.3%. Farm 3 exhibited the highest incidence of coccidiosis among the farms studied, indicating a high risk of outbreaks. Collectively, across the 15 flocks and a total of 16300 birds examined, ten flocks were positive for coccidiosis, resulting in an overall prevalence rate of 66.7% (Table 1).
The species distribution of Eimeria in coccidiosis-positive broiler flocks from different farms. The study aimed to identify the specific Eimeria species present in the positive flocks, providing insights into the diversity of the parasite species involved. In the case of NARC Farm, where one flock was positive for coccidiosis, no specific Eimeria species were reported. It is possible that the level of infection in this particular farm was below the detection threshold for species identification. Farm 1 had three coccidiosis-positive flocks, and the presence of two Eimeria species, namely Eimeria tenella and Eimeria maxima, was detected. This suggests a mixed infection involving these two species within the positive flocks in Farm 1. Similarly, Farm 2 reported two coccidiosis-positive flocks, with the presence of Eimeria necatrix and Eimeria acervulina. These two Eimeria species were found to be responsible for the coccidiosis outbreaks in Farm 2. Farm 3 exhibited the highest number of coccidiosis-positive flocks, with a total of five. The total number of coccidiosis-positive flocks across all farms was 11. However, the specific Eimeria species distribution for the total was not specified in the table. Therefore, the combined composition of Eimeria species across all positive flocks remains unknown. Understanding the species distribution of Eimeria in coccidiosis-positive broiler flocks is crucial for developing targeted control strategies and implementing effective management practices. By identifying the specific parasite species involved, farmers and researchers can focus on preventive measures, treatment protocols, and vaccine development that target the prevalent Eimeria species in their respective regions (Table 2). Table 3 shows that larger farm size, inadequate biosecurity measures, and poor feed quality are significantly associated with an increased risk of coccidiosis outbreaks in broiler production. Litter management, vaccination programs, and environmental factors do not show statistically significant associations with coccidiosis outbreaks.

**Table 1: Distribution of Coccidiosis in Broiler Flocks**

<table>
<thead>
<tr>
<th>Farm ID</th>
<th>Number of Flocks</th>
<th>Total Birds Examined</th>
<th>Number of Positive Flocks</th>
<th>Prevalence (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NARC Farm</td>
<td>1</td>
<td>384</td>
<td>0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Farm 1</td>
<td>5</td>
<td>5000</td>
<td>3</td>
<td>60.0</td>
<td>0.00033*</td>
</tr>
<tr>
<td>Farm 2</td>
<td>4</td>
<td>4800</td>
<td>2</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>Farm 3</td>
<td>6</td>
<td>6500</td>
<td>5</td>
<td>83.3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>16300</td>
<td>10</td>
<td>66.7</td>
<td></td>
</tr>
</tbody>
</table>

*indicated the significant value
Table 2: Species Distribution of Eimeria in Coccidiosis-Positive Broiler Flocks

<table>
<thead>
<tr>
<th>Farm ID</th>
<th>Number of Flocks</th>
<th>Eimeria Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>NARC Farm</td>
<td>1</td>
<td>Nil</td>
</tr>
<tr>
<td>Farm 1</td>
<td>3</td>
<td>E. tenella, E. maxima</td>
</tr>
<tr>
<td>Farm 2</td>
<td>2</td>
<td>E. necatrix, E. acervulina</td>
</tr>
<tr>
<td>Farm 3</td>
<td>5</td>
<td>E. necatrix, E. tenella, E. acervulina, E. maxima</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>-----</td>
</tr>
</tbody>
</table>

Table 3: Association Between Risk Factors and Coccidiosis Outbreaks

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Size</td>
<td>2.35</td>
<td>1.18 – 4.66</td>
<td>0.015*</td>
</tr>
<tr>
<td>Litter Management</td>
<td>0.72</td>
<td>0.43 - 1.21</td>
<td>0.206</td>
</tr>
<tr>
<td>Biosecurity Measures</td>
<td>0.53</td>
<td>0.31 - 0.91</td>
<td>0.021*</td>
</tr>
<tr>
<td>Vaccination Program</td>
<td>1.15</td>
<td>0.68 – 1.96</td>
<td>0.599</td>
</tr>
<tr>
<td>Feed Quality</td>
<td>1.82</td>
<td>1.02 – 3.25</td>
<td>0.042*</td>
</tr>
<tr>
<td>Environmental Factors</td>
<td>1.26</td>
<td>0.75 - 2.12</td>
<td>0.387</td>
</tr>
</tbody>
</table>

*indicated the significant value

DISCUSSION

The study presented focuses on epidemiology and risk factors of coccidiosis outbreaks in broiler production. Coccidiosis is a prevalent and economically significant parasitic disease that affects broiler chickens worldwide. The disease leads to impaired nutrient absorption, reduced growth rates, increased mortality, and substantial economic losses.

The study employed a cross-sectional design and collected data from multiple farms, using a sample size of 384 birds. Data collection involved direct observations, laboratory analyses, and field visits to gather information on farm characteristics, management practices, and biosecurity measures. Fecal samples were collected from broilers within the flocks, and standard parasitological techniques were used to identify and count Eimeria oocysts. Descriptive statistics were used to summarize the prevalence and distribution of coccidiosis outbreaks, while statistical analyses were performed to identify risk factors associated with the disease.

The prevalence rates varied among individual farms, with Farm 3 exhibiting the highest incidence of coccidiosis at 83.3%. The species distribution of Eimeria in the positive flocks also showed variation, with different farms having different combinations of Eimeria species. This highlights the diversity of the parasite species involved in coccidiosis outbreaks and emphasizes the need for targeted control strategies tailored to specific Eimeria species prevalent in each region.
The study also identified risk factors associated with coccidiosis outbreaks in broiler production. The results indicated that larger farm size, inadequate biosecurity measures, and poor feed quality were significant risk factors of coccidiosis. However, litter management, vaccination programs, and environmental factors did not show statistically significant associations with the disease. These findings provide valuable insights for poultry producers, veterinarians, and industry stakeholders, enabling them to implement targeted interventions to reduce coccidiosis.

The identification of specific Eimeria species involved in the disease and the assessment of risk factors contribute to the development of effective preventive measures and control strategies. By implementing targeted interventions based on these findings, poultry producers can minimize the occurrence and impact of coccidiosis outbreaks, improving broiler health, welfare, and economic performance in the industry.

CONCLUSION

The study identified the prevalence rates and specific Eimeria species involved in coccidiosis outbreaks, the study highlights the need for targeted control measures tailored to the prevalent parasite species in each region. The identification of risk factors such as larger farm size, inadequate biosecurity measures, and poor feed quality emphasizes the importance of implementing appropriate preventive measures to mitigate the occurrence and impact of coccidiosis in broiler production, thereby enhancing the health, welfare, and economic performance of broilers in the industry.

CONFLICT OF INTEREST

None.

REFERENCES: