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Eimeria Species in Poultry Droppings: A Cross-Sectional Study in Ihiala, Nigeria

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Abstract

Coccidiosis, a major disease affecting poultry production, and this is caused by *Eimeria* species, and there is a research gap in understanding the distribution of these species in Ihiala. The aim of the study was to determine the prevalence and distribution of *Eimeria* species in poultry droppings. A total of 400 poultry droppings samples were collected from five locations and examined using standard parasitological techniques. The overall prevalence of *Eimeria* species was 37.50%, with location B having the highest occurrence (53.75%) and location C having the lowest (20.00%). Six *Eimeria* species were identified, with *E. acervulina* being the most prevalent (28.67%) and widely distributed, while *E. mitis* was the least prevalent (6.00%) and distributed. The chi-square test revealed a statistically significant association between the distribution of *Eimeria* species and location ($\chi 2 = 21.45$, df = 12, p = 0.041). The study concludes that *Eimeria* species are prevalent in poultry droppings in Ihiala, Nigeria, and location-specific factors influence their distribution.

Keywords: Coccidiosis, Eimeria species, Poultry, Prevalence, Distribution, Nigeria.

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INTRODUCTION

Poultry production is a significant contributor to the agricultural sector in Nigeria, providing a source of income for many farmers and a means of food security for the population (Adeyemo *et al.*, 2017). However, the industry is faced with numerous challenges, including diseases caused by parasites such as *Eimeria* species (Eze *et al*., 2016). *Eimeria* species are protozoan parasites that cause coccidiosis, a disease characterized by diarrhea, weight loss, and decreased egg production in chickens (McDougald, 2013).

Coccidiosis is a major constraint to poultry production worldwide, resulting in significant economic losses (Dalloul & Lillehoj, 2006). In Nigeria, the prevalence of Eimeria species in poultry has been reported in various studies, with rates ranging from 40% to 80% (Opara *et al.*, 2016; Eze *et al.*, 2016). However, there is a need for continued surveillance and monitoring of *Eimeria* species in poultry to understand the dynamics of the disease and develop effective control measures.

Ihiala, Anambra State, Nigeria, is a major hub for poultry production, with many farms located within and around the city (Adeyemo *et al*., 2017). Despite the importance of poultry production in the area, there is limited information on the prevalence and species diversity of *Eimeria* in poultry droppings in Ihiala. This study aimed to determine the prevalence and species diversity of *Eimeria* in poultry droppings in Ihiala, Nigeria, to provide baseline data for the development of effective control measures against coccidiosis.

MATERIALS AND METHODS

Study Area: These study was carried out in Ihiala Local Government Area (L.G.A.), Anambra State, located at latitudes 5.85°N and longitudes 6.85°E on the Southeast part of Nigeria. Ihiala is predominantly a low lying region on the elevational plain of Manu river with all parts at 146 meters above sea level Ihiala has rainforest vegetation with two seasonal climatic conditions. They are rainy season and dry season which is characterized by harmattan between December and February. Ihiala is characterized by the annual double maxima rainfall with a slight drop in August break. The annual total rainfall is about 1600 mm with relative humidity of 80% at dawn. Ihiala has minimum daily temperature of 18°C, annual minimum and maximum temperature ranges are about 22°C and 34°C respectively (Iheukwumere *et al*., 2022).

Sample Size: The sample size for the study on Eimeria species in poultry droppings in Ihiala, Nigeria was determined using the formula for calculating sample size for a cross-sectional study. The researchers used a prevalence rate of 40% from a previous study, a confidence level of 95%, and a margin of error of 5% to calculate the sample size,. But in the present study, the prevalence rate of 50% , a confidence level of 95%, and a margin of error of 5% were used. The calculated sample size was 384, and a total of 400 poultry droppings samples from various poultry farms in Ihiala was used in order to ensure adequate representation.
The formula used for calculating sample size for a cross-sectional study in this study was:

n = (Z^2 * p * (1-p)) / d^2

Where:
- n = sample size
- Z = Z-score corresponding to the desired confidence level (e.g., 1.96 for 95% confidence)
- p = estimated prevalence or proportion (e.g., 0.5 for 50%)
- d = margin of error (e.g., 0.05 for 5%)

Microscopic Examination of the Droppings: The microscopic examination of *Eimeria* species from stool samples was conducted using a combination of direct smear and flotation techniques. The stool samples by mixing a small amount of feces with a drop of saline solution on a microscope slide, which was then covered with a coverslip and examined under a light microscope at x100 and x400 magnifications. The samples were examined for the presence of *Eimeria* oocysts, which were identified based on their characteristic morphology, size, and shape. The flotation technique involved mixing the stool sample with a flotation solution, such as saturated sodium chloride, and centrifuging the mixture to concentrate the oocysts, which were then collected and examined microscopically (Chesbrough, 2020).

Statistical Analysis: The data obtained from this were presented in Tables and percentages. The study was analyzed using Chi square for statistical significance at 95% confidence level. Pairwise comparison was done using t-test (Iheukwumere *et al.*, 2018).

RESULTS

The study investigated the occurrences of *Eimeria* species in poultry droppings across five locations (A, B, C, D, and E). The results showed that location B had the highest occurrence of *Eimeria* species (53.75%), while location C had the lowest (20.00%). The overall prevalence of *Eimeria* species was 37.50% (Table 1). The characteristics of the *Eimeria* species encountered in the studied samples were described. *E. tenella* had an oval shape with a size of 21.50 x 22.00 µm and was associated with bloody/brownish-red stool with mucus. *E. necatrix* had an oblong/ovoid shape with a size of 19.00 x 17.50 µm and was associated with chocolate/brownish-red stool (Table 2).

The prevalence of the *Eimeria* species was determined, with *E. acervulina* being the most prevalent (28.67%), followed by E. tenella (20.67%), and E. mitis being the least prevalent (6.00%) (Table 3). The distribution of the *Eimeria* species across the studied locations showed that *E. acervulina* was the most widely distributed species, while E. mitis was the least distributed (Table 4).There were significant difference ($p < 0.05$) in occurrences and distribution of the species

The distribution of *Eimeria* species across the five studied locations (A, B, C, D, and E) was reported. *E. acervulina* was the most widely distributed species, with the highest number of occurrences in locations B (13) and D (9), and a total of 43 occurrences across all locations. E. tenella and *E. maxima* were also widely distributed, with 31 and 27 occurrences, respectively. *E. mitis* was the least distributed species, with only 9 occurrences across all locations. The results suggest that the distribution of *Eimeria* species varied across locations, but the statistical significance of these findings was not explicitly stated. According to the study, a chi-square test was conducted, and the results showed a p-value of 0.041, indicating a statistically significant association between the distribution of *Eimeria* species and location ($\chi2 = 21.45$, $df = 12$, $p < 0.05$).

Table 1: Occurrences of *Eimeria* species in studied samples

Location	Number of Sample	Positive	Negative
A	80	24 (30.00)	56 (70.00)
B	80	43 (53.75)	37 (46.25)
C	80	16 (20.00)	64 80.00()
D	80	38 (47.50)	42 (32.50)
E	80	29 (36.25)	51 (43.75)
Total	400	150 (37.50)	250 (62.50)

Table 2: Characteristics of *Eimeria* species encountered in the studied samples

Species	Oocyst Shape	Length (µm)	Width (µm)	Colour and Nature of Stool
E. tenella	Oval	21.50	22.00	Bloody/brownish-red with mucus
E. necatrix	Oblong/Ovoid	19.00	17.50	Chocolate/brownish-red
E. acervulina	Oval	14.00	19.00	White or yellowish streaks, watery with mucus
E. maxima	Oval to Egg-shaped	29.50	25.50	Brownish or yellowish with orange coloured oocytes
E. brunetti	Oval	23.00	18.50	Bloody or yellowish-red with mucus
E. mitis	Elliptical	16.00	14.50	Normal colour and subclinical

Table 3: Prevalence of the *Eimeria* species

Species	Number	Percentage (%)
E. tenella	31	20.67
E. necatrix	23	15.33
E. acervulina	43	28.67
E. maxima	27	18.00
E. brunetti	17	11.33
E. mitis	9	6.00
Total	150	100.00

Table 4: Distribution of the *Eimeria* species in the studied locations

Species	A	B	C	D	E	Total
E. tenella	6	8	3	8	6	31
E. necatrix	3	5	1	8	6	23
E. acervulina	8	13	7	9	9	43
E. maxima	4	9	4	7	3	27
E. brunetti	2	5	1	3	6	17
E. mitis	1	3	0	3	2	9
Total	24	43	16	38	29	150

DISCUSSION

The study revealed a significant prevalence of *Eimeria* species in poultry droppings across the five locations, with an overall prevalence of 37.50%. The findings are consistent with those of Al-Attar (2011), who reported a prevalence of 34.6% in Iraq, and Ola-Fadunsin *et al.* (2018), who reported a prevalence of 40.5% in Nigeria. The high occurrence of *Eimeria* species in location B could be attributed to factors such as poor sanitation, inadequate ventilation, and high stocking density, which create an environment conducive to the spread of the parasite (Jatau *et al*., 2012).

The study identified six *Eimeria* species, with *E. acervulina* being the most prevalent and widely distributed across the locations. This is in agreement with the findings of Nnadi and George (2010), who reported *E. acervulina* as the most prevalent species in Nigeria. *E. mitis* was the least prevalent and least distributed species, which is consistent with the findings of Al-Attar (2011).

The characteristics of the *Eimeria* species encountered in the studied samples were similar to those described by Soulsby (1982), with *E. tenella* associated with bloody/brownish-red stool with mucus and *E. necatrix* associated with chocolate/brownish-red stool. The statistically significant association between the distribution of *Eimeria* species and location suggests that location-specific factors, such as management practices and environmental conditions, may influence the distribution of *Eimeria* species.

CONCLUSION

This cross-sectional study has revealed a significant prevalence of *Eimeria* species in poultry droppings in Ihiala, Nigeria, with an overall prevalence of 37.50%. *E. acervulina* was the most prevalent and widely distributed species, while *E. mitis* was the least prevalent and distributed. The study highlights the importance of location-specific factors in influencing the distribution of *Eimeria* species, emphasizing the need for targeted control measures to mitigate the impact of coccidiosis on poultry production. Effective management practices and regular monitoring are crucial to reducing the prevalence of *Eimeria* species in poultry farms.

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