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Coccidiosis: A threat to the poultry industry in Plateau State, Nigeria

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Target Audience: *Veterinary and Para veterinary workers; Poultry farmers and Researchers.*

Abstract

A five-year (2015 - 2019) retro-analysis of diagnostic records of the Helminthology laboratory, National Veterinary Research Institute, Vom was conducted to determine the prevalence of coccidiosis and mortality rates in poultry in Plateau state, Nigeria. From the total of 1346 intestinal tissues processed, 561 (41.7%) were positive for Eimeria spp. oocysts. Significantly ($p<0.05$) higher prevalence of coccidiosis was recorded during the wet season than the dry season (55% and 35.5%). Overall, in both seasons, layer farms had significantly higher ($p<0.05$) prevalence than broiler farms. Higher percent mean mortality was observed in the Eimeria spp. infected flocks compared to negative flocks (8% and 6.3%), although the difference was not significant ($p=0.15$). Generally, the mean percent mortality was higher in wet season than the dry season regardless of the infection status of the farms. More attention should be paid to the control of coccidiosis in poultry farms in Plateau state, through appropriate management and instituting bio-security measures in order to reduce the effects of the disease.

Key words: *Coccidiosis, Poultry, Industry, Animal scientists*

Description of problem

The poultry industry in Nigeria directly or indirectly provide employment and source of livelihood to a substantial number of youths and women which is in tandem with the Sustainable Development Goals (SDGs) 1, 2 and 3 (1). However, a major constraint to this promising industry is the menace posed by diseases amongst which is coccidiosis. Avian coccidiosis is caused by one or more of ubiquitous parasites of the genus *Eimeria* (*E. acervulina, E. brunetti, E. hagani, E. maxima, E. mitis, E. mivati, E. necatrix, E. praecox,* and *E. tenella*). It is a major disease of intensively reared poultry. This production system provides excellent predisposing condition for the eimerian parasites to accumulate in large number in the farm environment and thus be transmitted easily between susceptible hosts (2). The life cycle of *Eimeria* spp. are completed within a single host and comprises of asexual and sexual phases. Following these reproductive phases, large number of tough, resistant oocysts are produced and excreted in the host animal feces (3,4). The proliferation of the parasites and the subsequent transmission of the disease is favored by high humidity and warm temperatures which are characteristic of the Nigerian climate. Generally, the infection may result in clinical coccidiosis where the affected flock manifest clinical signs of the disease or subclinical coccidiosis where the birds are apparently disease-free but nevertheless have impaired production performance. Sometimes the flock may be lightly infected (coccidiasis) and exhibits normal health and production performance (5). Regardless of the level of infection, coccidiosis in poultry flocks is directly or indirectly responsible for reduced productivity leading to severe economic consequence on production (5−8).

The economic significance of coccidiosis is attributed to lower feed conversion, stunted

growth and high mortality. The costs incurred in treatment and prevention have been estimated to millions of dollars annually. In the United Kingdom for example, avian coccidiosis was previously ranked among the top three disease of poultry based on economic significance (9). Recently, the global annual costs attributed to the adverse effects of coccidiosis in chicken was deduced by geographical regions which amounted to tens of billion pounds, where the loss in the Nigerian poultry industry accounts for over 58 million pounds (10).

Although vaccines are available for the control of avian coccidiosis, chemotherapy remains the most effective option available to majority of poultry farmers in Nigeria. This is because of the cost of vaccines and technical considerations (11). Chemotherapy is also limited due to development of resistance to drugs and presences of drug residues in poultry products as well as environmental concerns, necessitating the search for safer control measures (12). Until this is achieved, farmers will continue to adopt measures aimed at reducing the cost of coccidiosis to their poultry production enterprises. The aim of this study was to assess the rate of mortalities due to *Eimeria* spp in chickens in Plateau State, Nigeria. This information will draw the attention of poultry veterinarians and farmers to the need to pay more attention to the control of this infection.

Materials and Methods

Five years (2015-2019) diagnostic records of the Helminthology Laboratory, Parasitology Division, National Veterinary Research Institute (NVRI), Vom, was analyzed for poultry coccidiosis infection. Data on poultry entries such as flock size, type of birds, date, laboratory result and mortality rate were extracted and analyzed using descriptive statistics. The data generated were entered into an excel spreadsheet and analyzed accordingly. The association between prevalence of coccidiosis and type of birds and season were analyzed using the T- test. Furthermore, the association between mean mortality and the season was assessed using the T- test. The level of significance was set at $p \leq 0.05$.

Table 1: Five-year (2015-2019) diagnostic record of coccidiosis in poultry farms in Plateau State Nigeria

Month of study	No of samples positive for *Eimeria* species /no. of samples examined (%)					Total (%)
	2015	2016	2017	2018	2019	
January	1/1 (100)	DNA	10/35 (28.6)	DNA	7/17 (41.2)	18/53 (33.9)
February	10/29 (34.5)	DNA	25/57 (43.9)	DNA	5/26 (19.2)	40/112 (35.7)
March	2/21 (9.5)	DNA	13/52 (25.0)	2/26 (7.7)	13/43 (30.2)	30/142 (21.1)
April	11/24 (45.8)	DNA	24/57 (42.1)	11/20 (55.0)	10/27 (37.0)	56/128 (43.8)
May	6/34 (17.6)	8/23 (34.8)	32/55 (58.2)	11/22 (50.0)	14/32 (43.8)	71/166 (42.8)
June	6/25 (24.0)	22/36 (61.1)	17/39 (43.6)	18/23 (78.3)	14/28 (50.0)	77/151 (51.0)
July	12/27 (44.4)	16/21 (76.2)	16/37 (43.2)	11/23 (47.8)	19/39 (48.7)	74/147 (50.3)
August	3/5 (60.0)	7/28 (25.0)	8/17 (47.1)	12/31 (38.7)	15/22 (68.2)	45/103 (43.7)
September	DNA	7/25 (28.0)	12/18 (66.7)	13/20 (65.0)	23/43 (53.5)	55/106 (51.9)
October	DNA	14/23 (60.9)	1/13 (7.7)	7/19 (36.8)	15/39 (38.5)	37/94 (39.4)
November	DNA	16/38 (42.1)	3/7 (42.9)	11/25 (44.0)	9/30 (30.0)	39/100 (39.0)
December	DNA	11/23 (47.8)	DNA	1/6 (16.7)	7/15 (46.7)	19/44 (43.2)
Total	51/166 (30.7)	101/217 (46.5)	161/387 (41.6)	97/215 (45.1)	151/361 (41.8)	561/1346 (41.7)

DNA-Data not available

Table 2: Seasonal occurrence of Coccidiosis in poultry farms in Plateau State, Nigeria

Season	No of samples positive for *Eimeria* species /no. of samples examined (%)					Total (%)	T	P
	2015	2016	2017	2018	2019			
Dry (Oct-Apr)	24/75 (32.0)	41/84 (48.8)	76/221 (34.4)	32/96 (33.3)	66/197 (33.5)	239/673 (35.5)		
Broilers	3/20 (15.0)	8/35 (22.9)	12/62 (19.4)	6/33 (18.2)	19/72 (26.4)	48/222 (21.6)	- 3.52	0.008*
Layers	21/55 (38.2)	33/49 (67.3)	64/159 (40.3)	22/63 (34.9)	47/135 (34.8)	187/461 (40.6)		
Rainy (May-Sept)	27/91 (29.7)	60/133 (45.1)	85/166 (51.2)	65/119 (54.6)	85/164 (51.8)	322/673 (47.8)		
Broilers	1/16 (6.3)	4/57 (7.0)	2/24 (8.3)	17/25 (68.0)	22/49 (44.9)	46/171 (26.9)	- 1.96	0.04*
Layers	26/75 (34.7)	56/76 (73.7)	83/142 (58.4)	48/94 (51.1)	63/115 (54.8)	276/502 (55.0)		

*Statistically significant

Results

A total of 1346 intestinal tissues were processed in the Helminthology laboratory, NVRI, Vom for the detection of intestinal parasites of poultry from January 2015 to December 2019. Data was not available for four months in 2015 and 2016 and for two months and one month in 2018 and 2017 respectively (Table 1). Overall, 561 (41.7%) of the samples were positive for *Eimeria* spp. The highest prevalence of 46.5% was recorded in 2016 while the least (30.7%) was in 2015 (Fig. 1, Table 1). Cumulatively, more than half of the samples examined in the months of June, July and September were positive for *Eimeria* spp. The lowest prevalence was recorded in March (Table 1).

Higher prevalence of coccidiosis was recorded during the wet season than the dry season (55% vs 35.5%). The prevalence in layer farms in 2016−2019 during the wet season was higher than fifty percent (51−74%) except in 2015 where it was 35%. However, in the dry season the prevalence in layer farms was below fifty percent except in 2016. Differently, the prevalence in broiler farms was mostly lower than fifty percent in both seasons. Overall, in both seasons, layer farms had significantly higher ($p<0.05$) prevalence than broiler farms (Table 2).

Table 3: Mean mortality recorded in farms according to season and *Eimeria* spp. infection status of the flock

Variables	Dry season		Wet season		Overall	
	Positive flock	Negative flock	Positive flock	Negative flock	Positive flock	Negative flock
Mean mortality (%)	5.23	5.40	9.89	7.57	8.00	6.32
Standard deviation	9.44	12.47	17.33	15.45	1.22	1.09
T-test	-2.21		-1.03		1.02	
P	0.014		0.15		0.15	

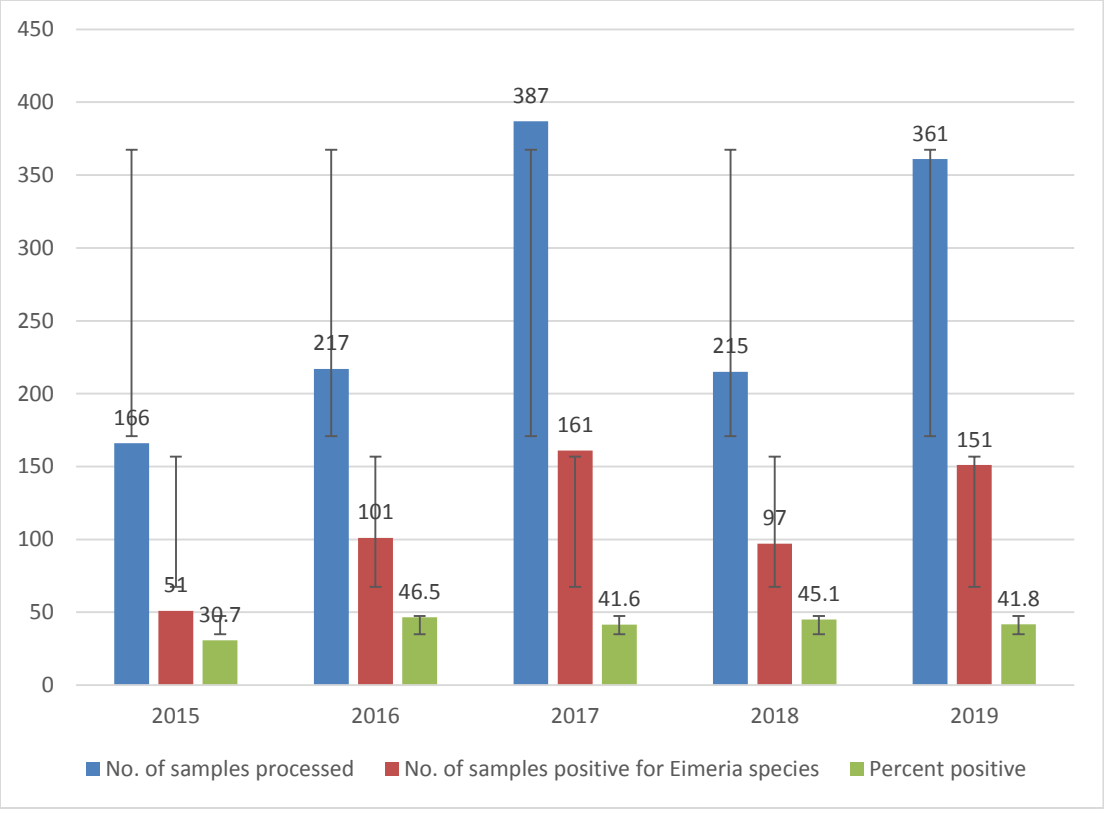

Figure 1: Five- year distribution of samples positive for *Eimeria* spp. from total samples analyzed for intestinal parasites of poultry in Plateau state, Nigeria (Bars represented mean SD).

Generally, a higher percent mean mortality was observed in the *Eimeria* spp. infected flocks compared to negative flocks (8% vs 6.3%), although the difference was not significant (p> 0.05). Furthermore, mean percent mortality was higher in wet season than the dry season regardless of the infection status of the farm (Table 3).

Data on flock size, anticoccidia regimen and age of birds were not properly captured for most farms, hence they were not included in the analyses.

Discussion

Assessing the factors that compromises profitable poultry production is imperative for formulating cost effective control measures for improving production. One of such factor is coccidiosis caused by *Eimeria* species which is a cosmopolitan disease in poultry industry. Although the condition does not usually cause massive mortalities in infected flock, it exerts significant economic effects through reduced feed conversion efficiency, weight gain, lowered immunity and sometimes death (5). Analyzing the trend in this five years (2015-2019) diagnostic retrospective study, a prevalence of 42% of *Eimeria* spp. infection was recorded. In all the reported cases during this period, *Eimeria* spp. were associated with mortalities, underscoring the role of this disease in poultry mortalities in Plateau state, Nigeria. This finding concurs with previous research reports on coccidiosis where the disease accounted for over 50% of morbidity and mortalities in poultry flocks in Turkey and

Romania (13,14).

Similarly, we observed higher prevalence of coccidiosis in layer birds compared to broilers which is in agreement with earlier report from Kaduna state, Nigeria (15,16). This finding could be attributed to the fact that layer birds are usually kept on deep litter system for longer periods than broilers thereby predisposing them to frequent contact with oocysts. Another risk factor could be stress of egg laying. Furthermore, because layers are kept for longer periods, they tend to develop some level of resistance to the coccidian parasite without showing overt clinical signs. The implication being that such adult layers continues to shed the oocysts in their feces thereby contaminating the premises and constituting source of infection to other birds on the farm.

The wet season was significantly associated with prevalence of coccidiosis in chicken in this study. Similar observation has been reported in Pakistan, where the seasons (Spring, Summer and Autumn) with higher rainfall recorded higher prevalence of coccidiosis than the winter (17). Generally, the environmental conditions during the wet season favors the sporulation and transmission of the infective oocysts to susceptible hosts. Particularly, most small holder poultry farms in this study area use makeshift or improvised housing which is prone to leakage or splashing of water during rainfall thereby wetting the litters. Such occurrence creates a conducive environment for oocysts sporulation, thereby predisposing to the disease.

Interestingly, we observed higher mean mortality in the *Eimeria* spp. infected flocks compared to negative flocks (8% vs 6.3%), suggesting the role of this parasite in poultry mortalities. Apart from mortalities, coccidiosis constitutes a major setback to poultry operation globally in terms of labor, treatment and vaccination associated costs. Recently, a global assessment of the cost of coccidiosis to poultry operation was estimated to cost over ten billion GBP (10), suggesting the huge economic impact of the disease.

Conclusion and Applications

1. The effective control of coccidiosis in poultry farms will significantly reduce the cost of production and improve income from poultry operations in Nigeria.
2. Considering the peculiarities and the range of the poultry production systems in Nigeria, a coccidiosis control program should be designed to provide options for the various categories of production systems.

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