PREVALENCE OF POULTRY COCCIDIOSIS, MORTALITIES AND SEVERAL ASSOCIATED EPIDEMIOLOGICAL FACTORS IN UMUAHIA, NIGERIA

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ABSTRACT. Coccidiosis, a parasitic infection, though self-limiting, is associated with significant and wide-ranging disease manifestations and economic losses. A study on the prevalence of coccidiosis, and some associated risk factors were investigated in 85 farms in Umuahia North and Umuahia South, Nigeria. Mucosal scrapings from the small intestine of dead birds showing clinical signs of coccidiosis in the study region were collected and analyzed for the presence of *Eimeria* oocyst. Primary data on several epidemiological aspects of coccidiosis were correspondingly collected from different poultry farms between the months of May and October 2016. An overall prevalence of 63 % of clinical coccidiosis was recorded with cecal coccidiosis having the highest prevalence of 65.9 % while intestinal coccidiosis with 21.5 %. It was found that the age group of 0-2 weeks showed 77 % infection, followed by 2-4 weeks old with 54.5 %, age group of 4-6 weeks with 32.5 %, 6-8 weeks with 16.9 %, and age group > 6 weeks with 49.2 %. Close to 8.6 % mortality was recorded across the study region with farms consulting veterinarians having the least mortality. Coccidiosis, especially the cecal form is very endemic in this region and is creating a significant loss in the poultry industry. A reduction in its prevalence and attendant negative impact on poultry production will entail adequate control measures including biosecurity practices, early prophylaxis, and the use of trained veterinarians.

Keywords: coccidiosis**,** *Eimeria*, epidemiological, prevalence, risk factors

INTRODUCTION

The poultry industry occupies an important position in the provision of animal protein (meat and egg) to man as well as manure for crops which generally plays a vital role in the national economy with regards to revenue and employment generation (Eduvie, 2002; Nnadi & George, 2010; Ola-Fadunsin, 2017). In most African countries, poultry provides about 12 kg of protein needs per inhabitants per year whereas cattle provide 5.3 kg by comparison (Nnadi & George, 2010; Nghonjuyi *et al*., 2014; Quiroz-Castañeda & Dantán-González, 2015). With its fewer social and religious taboos as well as the acceptability and attractiveness of its meat, poultry products have become one of the most important protein sources for mankind (Radfar *et al*., 2012; Beyene *et al*., 2014).

Avian coccidiosis is one of the most important parasitic diseases and has been one of the major threats in poultry production in Nigeria (Laseinde, 2002; Etuk *et al*., 2004; Akintunde & Adeoti, 2014; Ola-Fadunsin & Ademola, 2014; Ombugadu *et al.*, 2019), and indeed worldwide (Fayissa & Chalchisa, 2016; Gebremeskel & Tesfaye, 2016). Poultry coccidiosis is an economically important disease in chickens caused by the intracellular protozoa parasite of *Eimeria* species in the genus *Eimeria,* family *Eimeridae.* order *Eucoccidiorida* and phylum *Apicomplexa* (Taylor *et al*., 2007). Infection by coccidia in sufficient numbers to produce clinical manifestations of the disease is referred to as coccidiosis (Charlton, 2006; Conway & Mckenzie,

2007). This causes substantial economic loss to the poultry industries in Nigeria (Etuk *et al*., 2004; Musa *et al*., 2010; Usman *et al*., 2011). It is as one of the most economically important diseases of domestic poultry. As poultry is one of the most intensively reared domesticated animal species, the disease is ubiquitous (Williams, 1999; Opara *et al*., 2014). Out of the nine species of *Eimeria* commonly associated with chickens, seven of them are widely recognized as the causative agents of coccidiosis in chickens, of which *E. tenella*, *E. necatrix*, *E. maxima* and *E. brunetti* are highly pathogenic, *E. acervulina* and *E. mitis* are less pathogenic, whilst *E. praecox* is regarded as the least pathogenic (Foreyt, 2001; Shirley *et al.,* 2005; Conway & McKenzie, 2007; Taylor *et al.* 2007; Jadhay *et al.*, 2011;). Young birds are more susceptible to coccidiosis and therefore readily display signs of disease whereas older chickens are relatively resistant to infection (Abdisa *et al.,* 2019).

Prevalence of *coccidia* has been reported in all flocks worldwide (Awais *et al*, 2012; Györke *et al*., 2013; Dakpogan & Salifou, 2013; Olanrewaju & Agbor, 2014). In Nigeria, Muazu *et al*. (2008) had previously reported an overall 52.9 % prevalence of coccidiosis across the 36 states and the federal capital territory Abuja. There seems to be no report on the prevalence of avian coccidiosis in Umuahia, Abia State necessitating a need for this study.

Most prevalence studies concentrated mainly on laboratory diagnosis entailing the demonstration of the *Eimeria* oocyst in the small intestine without taking cognizance of the clinical manifestations cause by thus protozoan. Therefore, this study aims to determine the prevalence of poultry coccidiosis in Umuahia with associated risk factors as well as investigate the level of mortality associated with the disease and its occurrence.

MATERIALS AND METHODS

Study Area

The study was carried out in Umuahia, Abia state in the South-East of Nigeria. The study area comprises two local government areas - Umuahia North and Umuahia South of which five clans were involved. It lies within the latitudes of 4.4 ^{0} and 6.1 ^{0} North of the equator and longitudes of 7.0 ^{0} and 8.0 ^{0} East. It has a mean annual rainfall of about 187.7mm/year with the rainfall more intensive from April to October as recorded in 2016.

Study Population

The study population includes all the identifiable poultry farms, most of which are small holding units with capacities ranging from 100 to 6000 birds per farm. Eight of the farms are from Ohiya, 20 from Ibeku, 13 from Olokoro, nine from Umuopara, 13 from Ohuhu, and 22 from Ubakala making a total of 85 farms being investigated.

Sample Collection

Dead or sick birds from the farms constituting the sample population within the study period showing clinical signs of dullness, brownish or bloody diarrhea, clustering, drooping of wings, anorexia, and mortality were collected at the amount of two to five samples per farm. The total number of sick and affected birds manifesting the aforementioned clinical signs was recorded. Postmortem procedures were conducted on the dead birds with emphasis on their small intestines.

Information on some risk factors of the disease for each of the farms were obtained by using a questionnaire which includes bird type, age of birds, level of awareness of the disease, method of management, age at occurrence of coccidiosis and associated mortality. The study was carried out from March to October 2016 which was the major raining season of the year in the study area.

Processing of Samples

Mucosal scrapings of the small intestine and the ceca were carried out and the scrapings were examined microscopically for the presence of *Eimeria* oocysts. This was used as a confirmatory diagnosis for coccidiosis.

Test Tube Flotation Method

3 g of mucosal scrapings were added to 15 mLs of water. These were agitated with a spatula and passed through a 0.5 mm mesh sieve. The filtrate was poured into a test tube and centrifuged at 2000 rpm for five minutes. The supernatant was discarded, and 15 mL of saturated sucrose solution mixed thoroughly with the sediment was filled up to the brim with the saturated sugar solution. A clean glass coverslip was placed on the test tube for five minutes after which it was carefully removed with the drop of solution attached to it and placed on a clean glass slide. The slide was viewed at x10 magnification of the light microscope. Identification of the *Eimeria* oocysts was through morphological characteristics of the ova using the keys provided by Thienpoint *et al.* (1979).

Statistical Analysis

The data collected were entered into Microsoft Excel and analyzed using the software program for social science (SPSS) statistical software version 2.0. The association between the age of birds at infection, veterinary consultancy, awareness of coccidiosis, and mortalities were considered.

RESULTS

Prevalence According to Bird Type, Cecal, and Intestinal Coccidiosis

Out of 87,549 birds under study, 55,156 (63.0 %) were diagnosed with clinical coccidiosis. Broilers made up 43.8 % (24,179) while pullets and layers constituted 53.2 % (29,312) of the coccidiosis cases. Turkeys contributed 3.0 % (1,665) of the positive cases of clinical coccidiosis in the region. Prevalence due to cecal coccidiosis was 41.5 % whereas intestinal coccidiosis had a prevalence of 21.5 % leading to 63.0 % prevalence. Their relative contributions to the overall prevalence of 63.0 % are shown in Table 1.

Table 1. Prevalence of different types of coccidiosis based on bird type.

Bird type	Total no of birds	*Birds with intestinal coccidiosis	**Birds with cecal coccidiosis	***Birds without clinical coccidiosis	Total no. confirmed of coccidiosis	Prevalence (%)
Broilers	34,541	6,229	17,950	10,362	24,179	70.0
Pullets & layers	46,108	10,879	18,433	16,796	29,312	63.6
turkeys	6,900	1,665	-	5,235	1,665	24.1
Total	87,549	18,773	36,383	32,393	55,156	

*Number of birds diagnosed positive by clinical signs, postmortem lesions, and demonstration of oocyst (intestinal coccidiosis).

**Number of birds diagnosed positive by clinical signs (bloody feces), postmortem lesions (bloody cecal lesions) and demonstration of oocyst (cecal coccidiosis.)

***Number of birds diagnosed negative by absence of clinical sign.

Table 2. Prevalence of coccidiosis based on age of birds.

Age (weeks)	Total no. of farms	Total no. of birds	No of birds diagnosed positive	Prevalence %
0 – 2weeks	45	48,106	37,041	77.0%
2 – 4 weeks	23	24,841	13,540	54.5%
4 – 6 weeks	6	2,254	723	32.5%
6 – 8 weeks	7	6,849	1129	16.9%
>8	4	5,500	2705	49.2

Table 3. Farm location, associated risk factors and corresponding mortalities.

Location	No. of farms	No of birds	Broilers	Pullets + layers	Turkeys	Level of awareness %	Vet. Consultancy %	Mortality %
Ohiya	8	7100	3300	3800	-	50.0	50.0	2.3
Ibeku	20	22,425	7575	1,2750	2100	80.0	60.0	10.0
Olokoro	13	19,500	6307	9993	3200	84.6	61.5	15.4
Umuokpara	9	86,500	4450	4050	150	77.8	50.0	11.1
Ohuhu	13	18,525	7375	11,150	-	92.3	38.5	3.4
Ubakala	22	11350	5535	4365	1450	95.5	36.4	9.1
Total	85	87,550	34542	46108	6900	-	-	-

Table 4. Relationship between farms making use of vets and mortalities.

1-10%		Mortality						Total
		10-20%	20-30%	30-40%	40-50%	>60%		
Use of vet	Yes	25	6	2	1	0	0	34
	No	23	12	4	5	5	2	51
Total		48	18	6	6	5	2	85

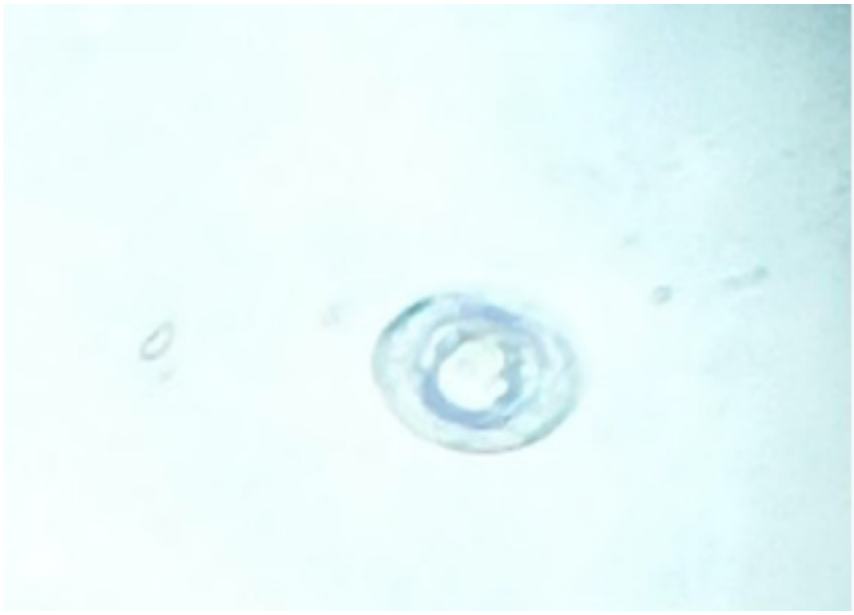

Figure 1. Detection of Eimeria oocyst in the intestine/caeca of chickens in Nigeria.

Prevalence According to Age

Most of the farms under study had early outbreaks during their brooding stage. About 80.0 % (68 farms) had outbreaks of coccidiosis before the 4th week with 45 of the farms (52.9 %) manifesting clinical coccidiosis before 2 weeks of age. There was a reduction in the prevalence as the birds got older up to the 8th week. In the few farms that had outbreaks after the eight weeks, the prevalence was high (49.2 %) due to the very high mortalities of 30 %, 30.6 % and 70 % recorded in some particular cases.

Other Risk Factors

The other risk factors examined in this study include awareness or knowledge of coccidiosis, usage of veterinary services, and flock mortality. The level of awareness ranged from 50.0 % in Ohiya to 95.5 % in Ubakala. It was also found that 83.0 % of all the farmers were aware of the disease while 17.0 % were not. The use of veterinarians varied between 36.5 % and 61.0 % which averaged 49.4 % across the study area. From the results, 56.5 % of the 87 farms recorded below 10 % mortality while 21.2 % of farms had 11 to 20 % mortality. The rest (22.3 %) had mortalities above 20 % from coccidiosis. Out of this 22.3 %, those that consult vets made up 3.5 % while those not making use of vets constituted the bulk (18.8 %) of farms with high mortalities as shown in Table 3. Paired t-test statistics show significant levels of difference ($p<0.05$) between those that consult vets and those that do not.

DISCUSSIONS

As a result of the intensive rearing system, coccidiosis remains an economically important disease for poultry industries worldwide (Adene & Oluloye, 2004). The result of the present study shows that poultry coccidiosis is endemic in the

study area with an overall prevalence of 63.0 % which is higher than the previous studies in 36 states and the federal capital territory Abuja in Nigeria (Muazu *et al*., 2008) and in Oyo (Adene & Oluloye, 2004) with the prevalence rate of 52.9 % and 51.5 - 97.6 %, respectively. It is much higher than the findings at Enugu (Nandi & George, 2010), Imo (Opara *et al*., 2012), Akwal bom (Majero, 1981; Etuk *et al*., 2004) with a prevalence rate of 35.5 %, 14.0 %, 29.36 % respectively. Outside Nigeria, a higher prevalences of 78.0 % in Jordan, 88.4 % in Argentina, and 92.0 % in Romania had been reported by McDougald *et al*. (1997), Al-Natour *et al*. (2002), and Gyorke *et al*. (2013) respectively. The relatively high prevalence of coccidiosis in this study might be due largely to management deficiencies and the period of the study that coincided with the rainy season. Coccidiosis is positively influenced by the warm and humid weather which characterizes the rainy season period and provide favorable conditions for the growth and development of the infective oocyst (Etuk *et al*., 2004; Abdisa *et al*., 2019). The deep litter system of management by farmers which constitutes the major system of management in this region makes direct contact between the birds and the infective oocyst inevitable (Abdisa *et al*., 2019). The lack of early prophylaxis could be responsible for the very high prevalence of 77.0 % at the first 2 weeks of age that contributed to the large proportion of the prevalence. This agrees with the earlier studies of Omer *et al*. (2011) and Lawal *et al*. (2016) which reported that younger birds are more susceptible to infection than older birds. The higher prevalence observed in broilers than in pullets and layers had equally been reported by Jatau *et al*. (2012) in Zaria, Northern Nigeria, Nnadi and George (2010) in Southeastern Nigeria, and Nematollahi *et al*. (2009) in Iran. This could be attributed to the more intensive feeding regimen of the broilers which predisposes the litter to more wetness than seen in pullets and layers. According to Chapman (2008), not much attention has been given on the prevalence of coccidiosis in turkeys, however the prevalence of 24.1 % recorded in this study is quite significant although the prevalence is lower compared to the prevalence in chickens. A lower prevalence of 21.7 % in turkey coccidiosis had been recorded by Jatau *et al.* (2017) in intensively reared turkeys.

The very wide difference in the prevalence across the age groups (shown in Table 2) within the region can be attributed to the dominance of cecal coccidiosis which had a very high prevalence as shown in Table 1. Cecal coccidiosis caused by *E. tenella* infections affects mainly naive chicks, (McDougald & Fitz-Coy, 2008) and has been shown to correlate with the most severe cecal pathology in poultry (Macdonald *et al*., 2017). This makes it the most pathogenic coccidiosis in chickens (Gyorke *et al*., 2013; Clark *et al*., 2016). Birds of any age are susceptible to coccidiosis, but most birds get infected in the early few weeks or even days of life (Chookyonix *et al*., 2009; Okonkwo *et al*., 2019) as observed in this study. This might be associated with the immature immune system in young birds (Lawal *et al*., 2016) and since chicks are not immunized against coccidiosis, they become highly susceptible to the infection. The marked reduction in the prevalence as the birds got older can be attributed to immunity acquired from the early infections.

The awareness of coccidiosis in this study is relatively high especially in Ohuhu and Ubakala districts and this appears to have a direct bearing on the level of mortality as shown by the lower level of mortality in these areas. A higher level of awareness will lead to better preparedness with regards to prophylaxis and husbandry management. The utilization of veterinary

services is rather low as shown in Table 3. This may be due to the high level of awareness by the farmers who felt that they knew what to do and hence did not need to incur any extra cost by employing the services of a vet. The consequence of this is a high level of preventable mortality associated with the low patronage of veterinary services. Therefore, out of the 13 farms that had coccidiosis prevalence above 30 %, 12 were not making use of vets, thus highlighting the importance of veterinary consult (Table 4). High mortality rates which ranged from 2.3 % in Ohiyia to 15.4 % in Olokoro (Table 3) were due largely to the age of the birds and the involvement of mainly the highly pathogenic cecal coccidiosis in the study. Musa *et al*. (2010) had earlier reported an outbreak in Zaria, Northern Nigeria in chicks with a 50.0 % mortality. Some farms in this study recorded higher levels of mortality probably due to other compounding diseases. Therefore, taking into consideration the reduced feed conversion ratio caused by subclinical coccidiosis, the high mortality reported, other diseases associated coccidiosis such as necrotic enteritis and opportunistic infections, for example, colibacillosis, the treatment cost of the disease may be much higher than being recorded.

CONCLUSION

There is a high prevalence of coccidiosis in the study region of 63.0 % where the prevalence of cecal coccidiosis from the clinical viewpoint was higher in younger birds. Even though there was a very high level of awareness of the disease, veterinary patronage varied according to location, and this appeared to have a direct effect on the mortalities across the different study regions. It is therefore recommended that the use of veterinary services both in increasing awareness and enhancing proper diagnosis, prophylactic, and chemotherapeutic interventions be employed. Furthermore, since coccidiosis is an ever-present possibility in floor reared chicken, its prevention demands that chemoprophylaxis be initiated early and the shift and shuttle methods employed appropriately to forestall resistance, a common problem in coccidial chemotherapy.

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