

Full Length Research Paper

Eimeria species oocyst morphometry and prevalence of Infection in domesticated pigeon (*Columba livia domestica*) in Maiduguri Metropolis Borno State, Nigeria

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Accepted 03 October, 2017

Prevalence of *Eimeria* species among domesticated pigeons (*Columba livia domestica*) in Maiduguri Metropolis was investigated. Flootation method was used to concentrate the coccidian oocysts using saturated sucrose solution. Sporulation technique was used to determine the size and morphological characteristics of the oocysts. Overall, 41 (40.6%) out of a total of 101 faecal samples examined were infected. Four parasite species under the genus *Eimeria* were isolated namely: *E. columbae*, *E. tropicalis*, *E. columbarum*, and *E. labbeana*; and at prevalence of 36.6%, 6.9%, 5.9% and 5.9% respectively. The difference in prevalence of the parasite species was significant ($\chi^2 = 76.577$, $p < 0.0001$). Young pigeons were significantly more infected (53.1%) than adults (28.2%) ($p < 0.05$). *E. tropicalis* oocysts had the largest size (21.5 μ m by 20.5 μ m) followed by *E. labbeana* oocyst (16.5 μ m by 15.0 μ m). *E. columbae* had the longest sporulation time of 96 hours while *E. labbeana* had the shortest, 24 hours. This study provides information on the prevalence and veterinary significance of *Eimeria* oocysts of pigeons in Maiduguri Metropolis.

Keywords: Coccidian, *Eimeria labbeana*, *Eimeria* oocyst morphometry, sporulation time.

INTRODUCTION

Coccidia are one-celled organisms which grow and multiply in the epithelial cells of various higher animals, often in the lining of the intestine, causing destruction of host tissues. An end-product of the multiplication cycle within the host is the microscopic spore (oocyst) which passes from the host body into the faeces. In most cases

the coccidian spore requires a developmental period (sporulation) in a moist place outside the host, in order to produce within itself the minute forms (sporozoites) which are capable of beginning again the parasitic multiplication within the host (Molta *et al.*, 1999). The main source of infection is oocyst-contaminated faeces; others include water, litter and feed. Freshly excreted oocysts in faeces are not pathogenic; but under proper conditions of humidity and temperature in the loft they mature, become invasive and capable of infecting birds.

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Coccidiosis, coccidian disease caused by *Eimeria* species is mostly found in young birds especially where these are intensively reared and when hygienic status is poor. Older birds acts as carrier and remain apparently healthy. In young pigeons the disease is acute and characterized by weight loss, excretion of blood streaked faeces and mortality ranging from 5% to 30% (Aleksandra and Pilarczyk, 2014). One infected pigeon may expel hundreds of millions oocyst per day (Saikia *et al.*, 2017). Coccidiosis is a major source of economic loss to the poultry industry globally, Nigeria inclusive (Chapman, 2008; Fornace *et al.*, 2013; Quiroz-Castañeda and Dantán-González, 2015). Infections also occur in pigeons (Aleksandra and Pilarczyk, 2014). The aim of these studies was to determine the prevalence of *Eimeria* spp. in domesticated pigeons in Maiduguri, Nigeria.

MATERIALS AND METHODS

The investigation of coccidian infection status amongst domesticated pigeon (*Columba livia domestica*) was conducted in Maiduguri, northeastern Nigeria. Maiduguri is located on latitude 11°4' N and longitude 13°0' E in semi arid Sahel. The Sahel is a marginal zone lying along the southern border of the Sahara Desert. The zone has a long dry season (October to May) and short wet season (June/July to September). Temperature ranges from less than 20°C during the dry harmattan period (November to February) to over 45°C during the late dry season (March to April).

Sampling Duration

A total of 101 pooled faecal samples of pigeons collected from different households and market places within the study area were used to assess the prevalence of coccidia infection in domestic pigeon. Sampling lasted for a period of one year from July 2016 to August 2017.

Processing and Examination of Faecal Samples

Approximately 5-10g of each sample was collected in separate screw-capped vials with proper labeling and brought to the Veterinary Parasitology Laboratory, University of Maiduguri, Borno State, Nigeria. The faecal samples collected were examined either on the same day or stored in a refrigerator at 4°C for subsequent screening. The faecal samples were first examined grossly to establish its consistency and color and presence of mucus, blood, etc. (Okoye, 2009). Subsequently, standard procedures were followed to determine the presence or absence of coccidian oocysts; floatation method was used to concentrate the coccidian oocysts using the saturated sucrose solution (specific

gravity: 1.27) standard procedure (Soulsby, 1982; Das *et al.*, 2015).

Identification of Coccidian Species

Faecal samples which were found positive for coccidian oocysts by floatation method were mixed with 2.5% potassium dichromate solution in medium sized petri-dishes and left at room temperature for sporulation of oocysts (Das *et al.*, 2015; Saikia *et al.*, 2017). Coccidia species were identified according to the size and morphological characteristics of the oocysts (the shape and color of the oocysts; thickness of the oocyst walls; presence of micropyle, cap, polar granules, oocyst or sporocysts deposit; size and shape of the sporocysts; shape of the steida bodies and of sporozoites, etc.) and sporulation time (Saikia *et al.*, 2017). Micrometry of oocyst of different coccidia species was done following the procedure described by Sloss *et al.* (1994). The identification of each species was made based on measurements of 25 oocysts from at least 4 samples (Saikia *et al.*, 2017).

Statistical Analysis

Data was analyzed using Statistical Packages for Social Sciences (SPSS) version 20.0 (IBM Corp., Armonk, USA). Chi-Square analysis was used to compare prevalence of infection. Level of significance was set at $p < 0.05$.

RESULTS

A total of 101 faecal samples from domesticated pigeon (*C. livia domestica*) collected from Maiduguri Metropolis were examined for coccidian infection. Only *Eimeria* spp. was the coccidian parasite isolated. Overall, 41(40.6%) of the samples were infected with *Eimeria* oocysts belonging to four species: *E. columbae*, *E. labbeana*, *E. tropicalis* and *E. columbarum* (Table 1). *E. columbae* had the highest prevalence (36.6%) while *E. labbeana* and *E. columbarum* had the least (5.9% each). The difference in prevalence of *Eimeria* species was significant ($\chi^2 = 76.577$, $p < 0.0001$).

The *Eimeria* species oocysts characteristics (morphometry, morphology and sporulation time) are summarized in Table 2. *E. tropicalis* oocysts which was spherical, had no micropyle, and was surrounded by a thin wall. *E. tropicalis* oocysts was the largest in size (21.5µm by 20.5µm) followed by *E. labbeana* oocyst (16.5µm by 15.0µm). *E. columbarum* had the smallest oocyst size (14.5µm by 12.5µm). *E. columbae* had the longest sporulation time of 96 hours.

Overall, more female (47.0%) than male (28.6%) were infected

Table 1. *Eimeria* species and prevalence of oocysts in pigeon (N = 101).

<i>Eimeria</i> species	No. of <i>C. livia domestica</i> Infected (%)
<i>E. columbae</i>	37 (36.6)
<i>E. tropicalis</i>	7 (6.9)
<i>E. labbeana</i>	6 (5.9)
<i>E. columbarum</i>	6 (5.9)
$\chi^2 = 76.577, p < 0.0001$	

N = number of pigeon examined.

Table 2. Morphometry, morphology and sporulation time of oocyst encountered in the study.

<i>Eimeria</i> Species	Morphometry and Morphology				Sporulation Time (hour)
	Average size (µm) Length*Breadth	Shape	Wall	Micropyle	
<i>E. columbae</i>	16.5*12.5	Oval	Thin	Present	96
<i>E. tropicalis</i>	21.5*20.5	Spherical	Thin	Absent	48
<i>E. labbeana</i>	16.5*15.0	Sub-spherical	Thick	Absent	24
<i>E. columbarum</i>	14.5*12.5	Spherical	Thin	Absent	25

(Table 3); however, there was no significant difference in the prevalence of *Eimeria* infection by sex of the birds ($\chi^2 = 3.210, p = 0.073$). Younger birds had more cases of infection with *Eimeria* than older ones (53.1% vs. 28.8%, $\chi^2 = 6.134, p = 0.013$). Similarly, prevalence of *E. columbae*, *E. tropicalis* and *E. labbeana* was higher in younger birds (46.9%, 10.2% and 8.2% respectively) than in older ones (26.9%, 3.8% and 3.8% respectively). Only the prevalence of *E. columbae* was significantly different between young and old birds ($\chi^2 = 4.354, p = 0.037$). Prevalence of *E. columbae* and *E. labbeana* were higher in female than male (40.9% vs. 28.9%) and (6.1% vs. 5.7%) respectively (Fig. 1). *E. tropicalis* (10.2% vs. 3.8%) and *E. columbarum* (8.6% vs. 4.5%) prevalence was higher in male than female birds. The differences in prevalence of *Eimeria* species between the male and female birds were not significant ($p > 0.05$).

DISCUSSION

The domesticated pigeon used for this study were raised mainly on free range and could easily be exposed to disease such as coccidiosis hence the high overall prevalence (40.6%) encountered. A similar prevalence of 49.2% of *Eimeria* spp. infection has been reported in

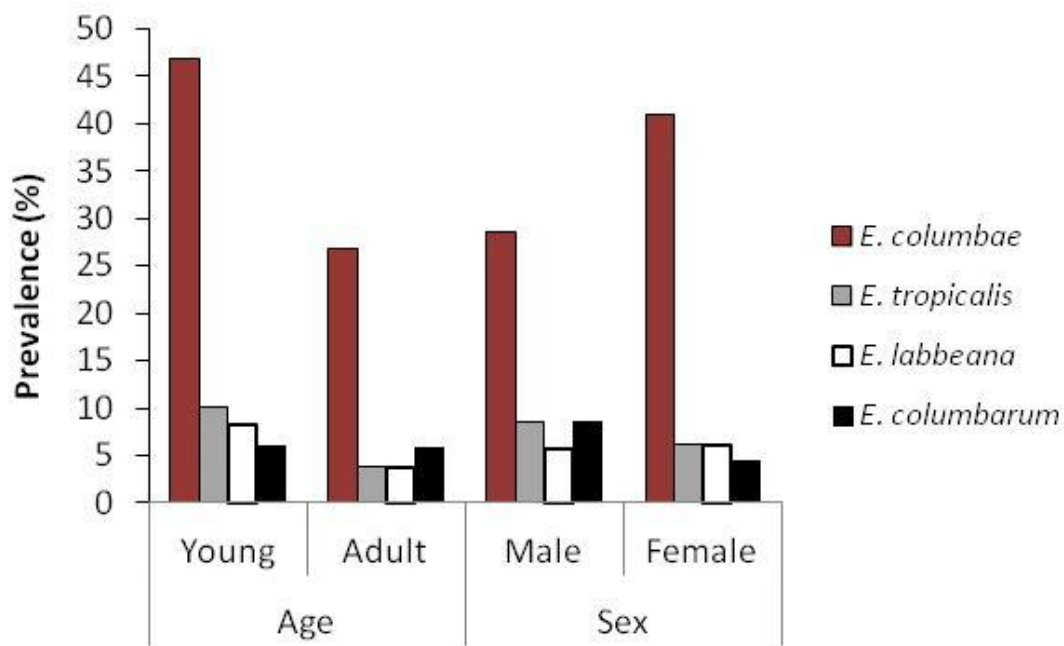
pigeon from Zaria, also in the northern part of Nigeria (Natala *et al.*, 2009). The study revealed that young pigeons were more commonly infected than adults; this agrees with the reports by Radfar *et al.* (2011), and Aleksandra and Pilarczyk (2014). Young and growing pigeons lack acquired immunity to coccidian infections and outbreaks can occur under conditions of poor hygiene (Dalloul and Lillehoj, 2005).

Pigeon coccidiosis may lead to diarrhea and thirst, blood tinge droppings, and marked intestinal inflammation with high mortality (Dalloul and Lillehoj, 2005; Bandyopadhyay *et al.*, 2006; Quiroz-Castañeda and Dantán-González, 2015). Hence pigeon rearing in this semi-arid zone should incorporate improved hygiene practice standards, in addition to prophylactic treatments using appropriate drugs (Adewole, 2012; Quiroz-Castañeda and Dantán-González, 2015).

In conclusion, Pigeon (*C. livia domestica*) reared under the free range system, in Maiduguri Metropolis had high prevalence of *Eimeria* spp. infection. This may greatly reduce productivity of these birds. Also, prevalence of infection was significantly higher in younger pigeon compared to older ones. Pigeon farmers in Maiduguri Metropolis should be enlightened on maintenance of adequate hygiene in farm.

Table 3. Prevalence of *Eimeria* oocysts according to sex and age of pigeons.

	No. Examined	No. Positive for <i>Eimeria</i> oocysts (%)	No. Negative for <i>Eimeria</i> oocysts (%)
Sex			
Male	35	10 (28.6)	25 (71.4)
Female	66	31 (47.0)	35 (53.0)
		$\chi^2 = 3.210, p = 0.073$	
Age			
Young	49	26 (53.1)	23 (46.9)
Adult	52	15 (28.8)	37 (71.2)
		$\chi^2 = 6.134, p = 0.013$	

**Figure 1.** Prevalence of *Eimeria* species by age and sex of pigeon.

CONFLICT OF INTEREST

There are no conflicts of interest.

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