

Original papers

Coccidiosis of domestic pigeons (*Columba livia domestica* Gmelin, 1789) in Kano State, Nigeria

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ABSTRACT. Pigeon coccidiosis is caused by *Eimeria* spp., a protozoan parasite which limits productivity by causing severe illness. Although numerous studies have been conducted on the coccidiosis of pigeons in some parts of Nigeria, there is no published data from Kano State. The intestinal contents of 144 pigeons (72 females and 72 males) were analysed for *Eimeria* oocysts in 2007 from 12 Local Government Areas of Kano State over the period of six months including the dry (February–April) and wet (June–August) seasons. The pigeons were divided into three groups according to age: squabs (0–4 weeks), squeakers (5–8 weeks) and youngsters (9+ weeks); each group including 48 pigeons. The results of these studies revealed an overall prevalence of 19.44%. The prevalence was higher in females (20.83%) than males (18.06%) ($p < 0.05$). Furthermore, squabs had the highest prevalence (27.08%) followed by squeakers (20.83%), and youngsters (10.42%) ($p < 0.05$). Infection with *Eimeria* spp. oocysts was higher during the wet season (8.96%) than dry season (5.98%) ($p < 0.05$). This study provides basic information on the first detection of coccidiosis of pigeons in Kano State, Nigeria which has an implication on the sustainable pigeon production for human protein requirement.

Key words: coccidiosis, *Columba livia domestica*, *Eimeria* spp.

Introduction

In Kano State, the domestic pigeon (*Columba livia domestica*) is reared for meat production by some households, thereby contributing significantly to the protein need of the local populace [1]. Although they are kept in lofts and fed with left overs by owners and neighbouring communities, they often fly out to scavenge for more supplements including various species of earthworms, dung beetles and ants [2,3], and can therefore be considered as feral [4]. They harbour a number of infective stages of various intestinal parasitic diseases, including coccidiosis [5]. Coccidiosis is a ubiquitous disease caused by protozoan parasites of the genus *Eimeria*, a complex and diverse group of protozoan parasites [6]. There are four species of

high importance in pigeon: *E. columbae*, *E. columbarum*, *E. labbeana* (most pathogenic) and *E. tropicalis* [7]. Pathogenic *Eimeria* causes severe enteric disease resulting in heavy financial losses in the global poultry industry, including pigeons [6]; it is often characterised by fluffy feathers, anorexia and watery diarrhoea with mucus, and results in mortality [8].

Previous studies have detailed the occurrence of coccidiosis globally [5–11] and in some parts of Nigeria [12–14]. However, there is paucity of information regarding coccidiosis in domestic pigeons in Kano State.

The present study determines the prevalence of coccidiosis in pigeons kept in the Kano central metropolis.

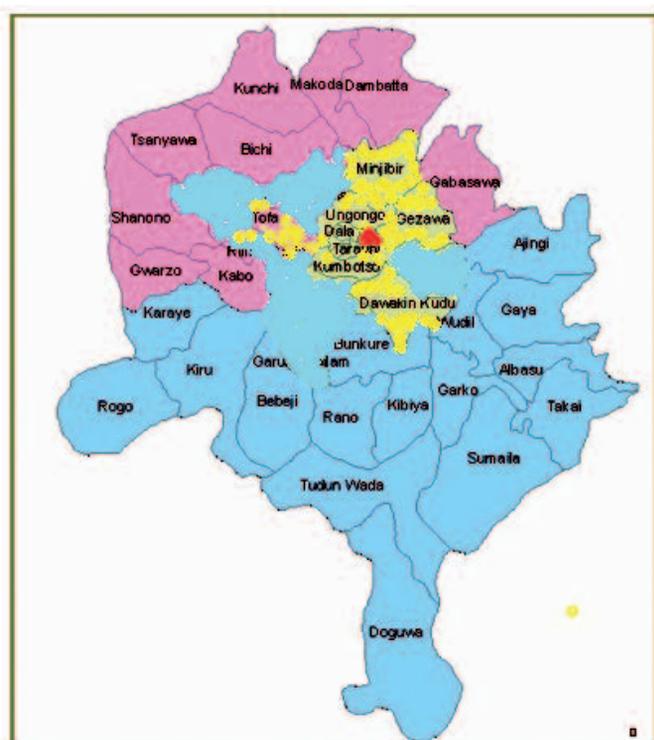


Fig. 1. Map of Kano State showing the study area (colored yellow). Dala, Fagge, Municipal, Nassarawa and Tarauni (colored red) are the Kano Central Government Areas. Adapted and modified from Dandalin Bashir, Kano State Local Government Areas and their codes (<http://dandalinbashir.Blog.spot.com.ng/2010/04/kano-state-is-highest-population-and.html>).

Materials and Methods

Kano State lies in the Sudan savannah zone of Nigeria (12°12'N 8°3'E) and is bordered by

Plateau, Bauchi and Katsina States to the North and East. It has a Sudan-type climate, with a mean temperature of 25°C. The wet season is from May to mid-October, with an annual rainfall of 1,000 cm³, whilst the dry season extends from mid-October of one calendar-year to mid-May of the next [1,15–16].

The study was conducted in 12 Central Local Government Areas of Kano State (Fig. 1). In total, 144 pigeons, comprising 72 males and 72 females, were examined during the dry (February to April, 2007) and wet (June to August, 2007) seasons. The pigeons were divided into three groups according to age: squabs (0–4 weeks), squeakers (5–8 weeks) and youngsters (9+ weeks), each group including 48 pigeons [1,17] (Fig. 2).

The pigeons were slaughtered and their intestinal contents were examined for *Eimeria* oocysts in the Faculty of Science Laboratory, Bayero University, Kano, Nigeria. In the laboratory, the sampled pigeons were necrotized and their intestines exposed as described by Fatihu et al. [18]. Faecal samples were collected from the intestines and subjected to parasitological analysis using the formol-ether concentration technique. Briefly, one gram of faeces was suspended in 10 ml of 10% formaldehyde solution and thoroughly mixed using a glass rod. The suspension was strained through a funnel covered with a gauze pad into a centrifuge tube. Following this, 3 ml of ether was added and the suspension mixed for one minute. The tubes were then centrifuged for two minutes at 2000 rpm. After discarding the supernatant, the sediment was

Table 1. Prevalence and intensity of infection with *Eimeria* spp. oocysts identified in pigeons from selected Local Government Areas of Kano State

S/No.	Local Government Area	Number sampled	Intensity of infection	Number infected	Prevalence (%)
1	Dala	12	++	3	25
2	Dawakin Kudu	12	+	1	8.33
3	Fagge	12	–	–	–
4	Gezawa	12	++	2	16.67
5	Gwale	12	++	2	16.67
6	Kumbotso	12	++	2	16.67
7	Minjibir	12	+++	3	25
8	Municipal	12	+++	5	41.67
9	Nassarawa	12	–	–	–
10	Tarauni	12	+++	4	33.33
11	Tofa	12	+++	3	25
12	Ungogo	12	+++	3	25
Total		144		28	19.44

Table 2. Sex and age related distribution of *Eimeria* oocyst in the sampled pigeons

		Number of examined	Number of infected	Prevalence (%)
Sex:	Male	72	13	18.06
	Female	72	15	20.83
Age:	Squabs (0-4 weeks)	48	13	27.08
	Squeakers (5-8 weeks)	48	10	20.83
	Youngsters (9 weeks +)	48	5	10.42

examined by taking a drop with a Pasteur pipette and depositing it on a glass slide. The slide was examined microscopically for *Eimeria* oocysts at $\times 10$ and $\times 40$ as described by Murray et al. [19]. The sex and age of the birds, as well as the collection site, were recorded as described by Urquhart et al. [20].

The intensity of coccidial infection was graded on a scale of + to +++ (+ mild, ++ moderate and +++ severe) of oocysts per gram (OPG) of faeces.

Differences in the numbers of oocysts between the pigeons according to sex and season were compared using the Student's t-test. Differences were regarded as significant at $p < 0.005$.

Results

In total, 19.44% of examined pigeons (28 of 144) were infected with *Eimeria* spp. oocysts. The oocysts were observed to be widespread across all the studied Local Government Areas of Kano State, except Fagge and Nassarawa (Table 1). *Eimeria* spp. oocysts were most predominant in squabs (27.08%), followed by squakers (20.83%) and youngsters (10.42%) ($p < 0.05$). The prevalence was higher in females (20.83%) than in males (18.06%) ($p < 0.005$) (Table 2), and during the wet season (8.96%) than the dry season (5.98%) ($p < 0.05$).

Discussion

Coccidiosis, one of the most common parasitic infections of poultry, is considered an important parasitic disease of pigeons causing heavy economic losses in the pigeon industry [11]. In this study, *Eimeria* spp. was found to infect pigeons of all ages and sexes with an overall prevalence of 19.44%. A similar high prevalence was recorded in pigeons in the province of Jos by Pam et al. [12] and in Owerri by Opara et al. [14]. This could be attributed to the free-range and semi-intensive

practices of rearing pigeons in parts of Nigeria, which expose the birds to substantial numbers of oocysts [13]. However, no clinical signs were observed as only the sub-clinical form occurred most frequently. After first ingesting some quantities of oocysts, the pigeons develop immunity to infection by the stimulation of endogenous defence mechanisms, without visibly succumbing to the disease. With this protection, immunity is reinforced by constant ingestion of low levels of oocysts; the birds live in a kind of equilibrium with the parasites, which also protects them against severe intestinal disease [21]. While squabs suffer the greatest losses to the clinical form of the disease, characterised by diarrhoea and sudden death, mortality may occur in birds as old as three to four months [22], and may occasionally be seen where birds are reared intensively and under poor hygiene conditions. Older birds only serve as carriers and remain apparently healthy [11]. Higher infection rates were reported in Hyderabad, India, 32.7% (121/370) [5], South Khorasan, Iran, (40.19%) [23] and Changhai, China, (55.2%) [10]. In addition, infection has been observed in 89–93% of squabs and squeakers and



Fig. 2. Pigeons in their natural environment (loft) from Municipal Local Government Area of Kano State
A – squabs; B – squakers; C – youngsters

63–55% of youngsters in Poland [24]. Further investigations revealed that, despite general good hygiene, conditions in the loft (Fig. 2) such as the type of litter and stocking density, are conducive to the proliferation of parasites and establishment of re-infection from the floor. In addition, attempts to rear birds in such coccidian surroundings were more likely to fail or result in severe infections once the birds were subsequently exposed [21].

In conclusion, our findings indicate that coccidiosis of domestic pigeons is prevalent in Kano State, with the potential to compromise the health status of the pigeons living there, and that constant veterinary surveillance is required to prevent economic losses in the pigeon breeding industry. The results of this study also provide basic guidance for the establishment of efficient control strategies against coccidiosis in domestic pigeons.

References

- [1] Rabiou B.M., Arzai A.H. 2012. Incidence of *Pseudolynchia canariensis* (Macquart) of domestic pigeons (*Columba livia domestica*) in Kano State-Nigeria. *Biological and Environmental Sciences Journal for the Tropics* 1: 102-105.
- [2] Haemig P.D., de Luna S.S., Blank H., Lundqvist H. 2015. Ecology and phylogeny of birds foraging at outdoor restaurants in Sweden. *Biodiversity Data Journal* 3: e6360. <https://doi.org/10.3897/bdj.3.e6360>
- [3] Matsubara R., Fukuda Y., Murakoshi F., Nomura O., Suzuki T., Tada C., Nakai Y. 2017. Detection and molecular status of *Isospora* sp. from the domestic pigeon (*Columba livia domestica*). *Parasitology International* 66: 588-592. <https://doi.org/10.1016/j.parint.2017.05.004>
- [4] Blasco R., Finlayson C., Rosell J., Marco A.S., Finlayson S., Finlayson G., Negro J.J., Pacheco F.G., Vidal J.R. 2014. The earliest pigeon fanciers. *Scientific Reports* 4: 5971. doi:10.1038/srep05971
- [5] Kommu S., Rajeshwari G., Sreenivasamurthy G.S. 2016. Prevalence of helminthic and protozoan infections in pigeons-in and around Hyderabad of Telangana state. *Journal of Parasitic Diseases: Diagnosis and Therapy* 1: 1-3.
- [6] Yang R., Brice B., Elloit A., Ryan U. 2016. Morphological and molecular characterization of *Eimeria labbeana*-like (Apicomplexa: Eimeriidae) in a domestic pigeon (*Columba livia domestica*, Gmelin, 1789) in Australia. *Experimental Parasitology* 166: 124-130. <https://doi.org/10.1016/j.exppara.2016.04.009>
- [7] Krautwald-Junghanns M.E., Zebisch R., Schmidt V. 2009. Relevance and treatment of coccidiosis in domestic pigeons (*Columba livia* forma *domestica*) with particular emphasis on toltrazuril. *Journal of Avian Medicine and Surgery* 23: 1-5. doi:10.1647/2007-049r.1
- [8] Latif A.A., Fazal S., Manzoor F., Maqbool A., Asghar S., Wajid I., Ashraf A. 2016. A comparative study on prevalence of coccidian parasites in broiler chicken (*Gallus gallus domesticus*), Japanese quail (*Coturnix coturnix japonica*) and wild pigeon (*Columba livia*). *Pakistan Journal of Zoology* 48: 295-297.
- [9] Mushi E.Z., Binta M.G., Chabo R.G., Ndebele R., Panzirah R. 2001. Seroprevalence of *Toxoplasma gondii* and *Chlamydia psittaci* in domestic pigeons (*Columba livia domestica*) at Sebele, Gaborone, Botswana. *Onderstepoort Journal of Veterinary Research* 68: 159-161.
- [10] Dong H., Zhao Q.-P., Han H.-Y., Cheng J., Jiang L.-L., Zhu S.-H., Zeng Y.-B., Ma W.-J., Huang B. 2012. Prevalence and species identification of *Eimeria* infection in pigeons in Shanghai. *Chinese Journal of Animal Infectious Diseases*: 64-68 (in Chinese).
- [11] Balicka-Ramisz A., Pilarczyk B. 2014. Occurrence of coccidia infection in pigeons in amateur husbandry. Diagnosis and prevention. *Annals of Parasitology* 60: 93-97.
- [12] Pam V.A., Ashi R.R., Daniel L.N., Omalu C.J. 2006. The role of wild birds in the dissemination of parasite infection in Jos (North and South), Plateau State, Nigeria. Proceedings of the 3rd Annual Conference of the Zoological Society of Nigeria, November 7 to 10th 2006, Nasarawa State University, Keffi, Nigeria: 37.
- [13] Natala A.J., Asemadahun N.D., Okubanjo O.O., Ulayi B.M., Owolabi Y.H., Jato I.D., Yusuf K.H. 2009. A survey of parasites of domesticated pigeon (*Columba livia domestica*) in Zaria, Nigeria. *International Journal of Soft Computing* 4: 148-150.
- [14] Opara M.N., Ogbuewu I.P., Iwuji C.T., Njoku L., Ihesie E.K., Etuk, I.F. 2012. Blood characteristics, microbial and gastrointestinal parasites of street pigeons (*Columba Livia*) in Owerri Imo State, Nigeria. *Scientific Journal of Animal Science* 1: 14-21.
- [15] Olofin E.A. 1987. Some aspects of the physical geography of Kano Region and related human responses. Departmental lecture note series no. 1, Department of Geography, Bayero University, Kano.
- [16] Olofin E.A. 2008. The physical setting. In: *Wudil Within Kano Region: A Geographical Synthesis*. (Eds. E.A. Olofin, A.B. Nabegu, A.M. Dambazau). Kano City, Adamu Joji Publishers: 5-34.
- [17] Williams C.S.F. 1976. Practical Guide to Laboratory Animals. Mosby Inc., Saint Louis, USA.
- [18] Fatihu M.Y., Ogbogu V.C., Njoku C.O., Saror D.I. 1991. Comparative studies of gastrointestinal helminths of poultry in Zaria, Nigeria. *Revue d'élevage et de Médecine Vétérinaire des Pays Tropicaux* 44: 175-177.

- [19] Murray P.P., Drew W.L., Kobayashi G.S., Thompson J.H. 1990. *Medical Microbiology*. Mosby Inc., Saint Louis, USA.
- [20] Urquhart G.M., Armour J., Duncan J.L., Dunn A.M., Jennings F.W. 1996. *Veterinary Parasitology*. Wiley & Sons Inc., USA.
- [21] Mohammed B.R. 2009. A survey of ecto- and intestinal parasites of pigeons (*Columba livia domestica*) in selected local government areas of Kano State, Nigeria. Master of Science Dissertation, Bayero University, Kano State, Nigeria.
- [22] Saif Y.M., Barnes H.J., Glisson J.R., Fadly A.M., McDougald L.R., Swayne D.E. 2003. *Diseases of poultry*. 11th ed., Iowa State Press, Iowa.
- [23] Radfar M.H., Asl E.N., Seghinsara H.R., Dehaghi M.M., Fathi S. 2012. Biodiversity and prevalence of parasites of domestic pigeons (*Columba livia domestica*) in a selected semiarid zone of South Khorasan, Iran. *Tropical Animal Health and Production* 44: 225-229. doi:10.1007/s11250-011-0002-3
- [24] Raś-Noryńska M., Michalczyk M., Sokół R. 2011. Coccidia infections in homing pigeons of various age during the racing season. *Wiadomości Parazytologiczne* 57: 165-168.

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