

Research Article

Prevalence of *Eimeria* infection in domestic pigeons (*Columba livia domestica*) in Shanghai, China

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Abstract

The prevalence of coccidial infection in domestic pigeons (*Columba livia domestica*) from Shanghai was examined in May 2017. A total of 254 fecal samples (210 from meat pigeons and 44 from homing pigeons) were examined; oocysts were identified to the species level based on morphological features. The overall prevalence of coccidial infection was 52.8% (134/254), with prevalence of 55.2% (116/210) for meat pigeons and 40.9% (18/44) for homing pigeons. 5 species of *Eimeria* were identified, namely, *Eimeria labbeana*, *E. kapotei*, *E. duculai*, *E. columbae* and *E. columbarum*. The most common *Eimeria* species in meat pigeons and homing pigeon pigeons was *E. labbeana* and *E. columbarum*, respectively. *E. duculai* was recorded for the first time in pigeons in China. Concurrent infection with 2-5 species was common. The results of the present investigation have implications for the control of coccidial infections in domestic pigeons in Shanghai.

INTRODUCTION

Coccidia are protozoan parasites that can affect a wide variety of mammalian and avian species, and they are common pathogenic parasites in pigeons [1]. The subclinical infection is most common, with the pigeons being asymptomatic carrier. Clinical coccidiosis occurs only after massive ingestion of sporulated oocysts, especially in young squabs, or when immune-suppressive condition is present [2]. A greenish diarrhea is the primary clinical sign, alone with weakness, ruffled appearance, and anorexia [3]. The reported prevalence of *Eimeria* infection in pigeons was 15.1% in Turkey [4], 36% in Germany [5], 49.2% in Nigeria [6], 50% in Belgium [7], 71.9% in Slovenia [8], 35.8% in USA [9], and 11.5% in Chile [10].

In China, the first report of coccidiosis in pigeons occurred in 1984 [11]. Since then, pigeon coccidiosis has been reported in a limited number of areas. The prevalence ranges from 45.7% to 91.4%, depending on the geographic area [12-15]. However, there have been no studies of prevalence in Shanghai. Therefore, the aim of this study was to determine the prevalence of *Eimeria* spp. in pigeons in Shanghai, China.

MATERIALS AND METHODS

Fecal sampling

In total, 210 and 44 fresh fecal samples were collected from 2 meat pigeon farms and 1 homing pigeon farm from Shanghai in May 2017, respectively. The choice of farms depended on the

cooperation of the animal owners. The collected samples were stored at 4°C until being examined.

Oocyst counting

Each fecal sample was examined for the present or absence of coccidial oocysts by a flotation technique using saturated solution of sodium chloride. Coccidial oocysts per gram (OPG) of feces were determined quantitatively by a modified McMaster technique [16]. Briefly, two grams of fecal material was mixed thoroughly with 30 ml of tap water and filtered through a 150-mm mesh copper sieve. The filtrate was centrifuged at 3,000 g for 5 min. The sediment was suspended with saturated sodium chloride solution, with a final volume of 30 ml, and mixed completely. Two McMaster counting chambers (2×0.15 ml) were filled with the suspension and examined with the use of a light microscope after standing for 10 min. The mean number of oocysts in the 2 chambers was multiplied by the dilution factor (100) to obtain the number of OPG. This method has a sensitivity of 100 oocysts per gram of feces.

Species identification of *Eimeria*

The remainder of each positive fecal sample was suspended with 2.5% potassium dichromate solution and incubated at room temperature for several days to allow oocysts to sporulate. For identification, a flotation of the sediment in saturated sodium chloride solution was performed. Oocysts identification were made with the use of light microscopy at 400×magnification, according to their sizes and morphological characteristics (shape,

Table 1: Prevalence of *Eimeria* infection in domestic pigeons in Shanghai, China.

Locality	Meat pigeons		Homing pigeons	
	Examined no./positive no./prevalence (%)	Average OPG (range)	Examined no./positive no./prevalence (%)	Average OPG (range)
Fengxian	110/67/60.9	25400 (300-35700)	44/18/40.9	37583 (300-127500)
Nanhui	100/49/49.0	88634 (3900-512400)	-	-
Total	210/116/55.2	52110A (300-512400)	44/18/40.9	37583B (300-127500)

Table 2: Species of *Eimeria* identified and their prevalence in domestic pigeons in Shanghai, China.

Species	Meat pigeons		Homing pigeons
	Positive number/prevalence (%)		Positive number/prevalence (%)
	Fengxian (n=67)	Nanhui (n=49)	Fengxian (n=18)
<i>E. labbeana</i>	25/37.3	20/40.8	5/27.8
<i>E. columbae</i>	16/23.9	10/20.4	3/16.7
<i>E. columbarum</i>	9/13.4	10/20.4	8/44.4
<i>E. duculai</i>	12/17.9	5/10.2	2/11.1
<i>E. kapotei</i>	5/7.5	4/8.2	-

Table 3: Number of coccidia species present in individual positive fecal samples of domestic pigeons in Shanghai, China.

No. of <i>Eimeria</i> species	Meat pigeons		Homing pigeons
	Positive no./prevalence(%)		Positive no./prevalence(%)
	Fengxian (n=67)	Nanhui (n=49)	Fengxian (n=18)
1	3/4.5	4/8.2	3/16.7
2	20/29.9	16/32.7	8/44.4
3	31/46.3	19/38.8	5/27.8
4	8/11.9	8/16.3	2/11.1
5	5/7.4	2/4.0	-

colour, form index, presence or absence of micropyle and its cap, presence or absence of residual, polar and Stieda bodies) of the oocysts and sporocysts [17].

STATISTICAL ANALYSIS

Differences in prevalence and average OPG of coccidia between meat pigeons and homing pigeons, as well as between different regions were evaluated using a Chi square test in SPSS for Windows (SPSS 12.0 for Windows, SPSS Inc., Chicago, Illinois), and a value of $P < 0.05$ was considered significant.

RESULTS AND DISCUSSION

Coccidiosis in pigeons has been reported worldwide. In the present survey, *Eimeria* oocysts were found in 134 of 254 fecal samples (52.8%) obtained from the three pigeon farms (Table I), showing that infections with coccidia in pigeons are very common in Shanghai. Our results are similar to those reported in Belgium, Guangdong province of China and Nigeria [6,7,11] but lower than the data reported in Slovenia and Henan province of China [8,14]. Many factors may contribute to the different prevalence, including climatic conditions, farm practices, and pigeon breeds.

The prevalence of meat pigeons (55.2%) and the average OPG (52 110) were much higher than that of the Homing pigeons

(40.9% and 37 583) ($P < 0.05$), respectively. The prevalence of meat pigeons in Fengxian district (60.9%, 67/110) was much higher than that in Nanhui district (49.0%, 49/100) ($P < 0.05$). However, the average OPG of Nanhui District (88 634) was much higher than that of the Fengxian district (25 400) ($P < 0.05$) (Table I). These results indicate that the prevalence of *Eimeria spp.* infection varies dramatically between regions and breed groups.

To date, 9 species of *Eimeria* have been documented from pigeon worldwide [1]. In China, 5 *Eimeria* species have been found in pigeons, namely *E. labbeana*, *E. tropicalis*, *E. kapotei*, *E. columbarum* and *E. columbae* [12-15]. But in the present study, we found five species in meat pigeons and four in homing pigeons (Table II). One species, *E. duculai*, was recorded for the first time in pigeons in China. The most commonly found species in meat pigeons was *E. labbeana*. In homing pigeons, *E. columbarum* was the more frequently found. Mixed infection with two or three *Eimeria* species was more commonly seen than infection with a single *Eimeria* species (Table III), consistent with the findings of other researchers [14,15,18].

In Europe, coccidiosis in racing pigeons is caused primarily by *E. labbeana* and *E. columbarum* [2]. Though these two species were found to be the most prevalence species in meat pigeons and homing pigeons in the present study, but no cases of clinical

coccidiosis were found and all the pigeons appeared healthy. As the intensity of *Eimeria* infection (estimated as average OPG) in meat pigeons and homing pigeons was 52110 and 37583, respectively, subclinical infections are likely to be frequent in the three pigeon farms in Shanghai. The disease may occur under stress factors such as weaning, dietary changes, inclement weather or travel and regrouping. Therefore, it is necessary to carry out integrated strategies to control coccidial infection in this area.

CONCLUSION

Infections with coccidia in pigeons are very common in Shanghai. The results of the present investigation have implications for the control of coccidial infections in domestic pigeons in Shanghai.

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AUTHORS' CONTRIBUTIONS

HD and BH conceived and designed the experiments. QZ, HH and SZ helped to carry out various aspects of the experiments. HD and HB drafted and revised the manuscript. All authors read and approved the final version of the manuscript.

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