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Prevalence of coccidia in domestic pigeons (*Columba livia domestica* Gmelin, 1789) in Benghazi city, Libya

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ABSTRACT

Coccidiosis is a disease caused by Eimeria spp; which is one of a protozoan parasite. The disease limits birds' performance by causing severe illness and decrease the utilisation of nutrients. The current study was carried out to investigate the prevalence of coccidiosis on domestic pigeon in Libya. Intestinal contents of 100 pigeons (Columba livia domestica Gmelin, 1789) were collected within a period of five months; January to May 2020. The intestinal content was examined to detect of coccidian oocysts infection on the randomly selected birds. A total of 100 faecal contents were investigated with two methods; Willis-Schaafs (qualitative) and McMaster's (quantitative). The results obtained showed that the number of infected Pigeons was 72 pigeons (72%) of the total number of Pigeons. The prevalence of coccidiosis in the domestic pigeons was significantly higher in females than that of males (Chi square = 38.89, P = <0.0001), where the total of infected females was 50 (69.4 %) and infected males was 22 (30.6%). In terms of pigeons' age, the findings exhibited that the highest incidence of Eimeria labbeana was observed in the young pigeons than that of adults (Chi square = 75.49, P = <0.0001), where the total number of young pigeons was 66 (91.7 %), and adult pigeon was 6 (8.3 %). In conclusion, the current findings can be utilised by the pigeon keepers and create a significant awareness against public veterinarian health

Introduction

Pigeons often live in nature contacting with the other species of poultry. This relationship with the other fowls leads to transfer and spread the diseases. Pigeons are reared worldwide for meat production (Mohammed *et al.,* 2017), racing, performing and fancy purposes (Eljadar *et al.,* 2012). In Libya, pigeons are mainly reared for fancy, performing purposes and meat consumption (Eljadar *et al.,* 2012; Alkharigy *et al.,* 2018). These birds have a size ranged between 30.5 – 35.5 cm, and body weight ranging from 180 – 355 g (De La Ossa V *et al.,* 2017). During the racing season, pigeons perform a large number of flights which lead to substantial exhausting of the birds. Therefore, increase the susceptibility to various diseases such as parasites, including salmonellosis or coccidiosis (Balicka-Ramisz and Pilarczyk, 2014a). Diseases like coccidiosis, histoplasmosis, cryptococcosis, encephalitis, newcastle disease, toxoplasmosis and salmonella food poisoning may occur in pigeons (Kamal *et al.,* 2020).

Coccidia are common protozoal pathogen in pigeons which grow and multiply in the intestinal epithelium cells. Coccidia are intracellular parasites, often resulting in disruption of the intestinal mucosa. Lateral and vertical transmission is by mechanical contamination with the reproductive forms (oocysts) (McDougald *et al.,* 2020). Coccidia are mostly occurring in young birds; especially when the birds reared intensively or when hygienic status is poor. The mature birds act as carrier and remain apparently healthy. The previous literatures worldwide described nine species of genus *E. imeria* and one of the genus *Isospora* (Abdisa *et al.,* 2019). However, only

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three species are significant; *E. imeria columbae*, *E. columbarum*, and *E. labbeana* which are characterised by different degree of severity. *E. labbeana* and *E. columbae* were reported in 1928 and 1953, respectively(Balicka-Ramisz and Pilarczyk, 2014b). In addition, the incidence was observed in domestic pigeons (Krautwald-Junghanns *et al.,* 2009).

Coccidia are caused mainly by *E. labbeana* which is manifested by weakening the immunity of birds. It is known that *Eimeria* may cause severe disease leading in economic losses in poultry industry. (Abdisa *et al.,* 2019). The symptoms can be described by watery diarrhoea associated with mucus. (Mohammed *et al.,* 2017). One infected bird may release millions of oocysts a day. The invasive forms are fully sporulated with oocysts (Balicka-Ramisz and Pilarczyk, 2014b).

Oocysts released in the faeces (non-sporulated) are not pathogenic, whereas if environmental conditions are available from moisture and temperature, they will be invasive and able to infect the birds (López-Osorio *et al.,* 2020). Feeding a portion of soluble and insoluble fibre in poultry feed may lead to enhance the gut health (Alshelmani *et al.,* 2021).

Although several researches have been conducted on coccidiosis of birds worldwide, the information of its prevalence in Libya still limited. Therefore, the objective of the current study was to determine the prevalence of coccidiosis in domestic pigeons reared in Benghazi city, Libya.

Materials and Methods

Site and time period of the study

The investigation of coccidian infection status amongst pigeons (*Columba livia domestica*) was conducted in Benghazi, Northeastern Libya. The coordinate was 32.1194° North, 20.0868° East. The study was conducted from January to May 2020.

Experimental animals

A total of 100 samples of pigeons were collected from different households were used and examined in the current study. The size of the birds was ranged from 32 – 34 cm, and their body weights were ranged between 200 – 230 g. The length of the tongue which was 2 cm and 3 cm considered as young and adult pigeon, respectively (Abumandour and Kandyel, 2020). In addition, the age of birds with three months and six months or above considered as young and adult, respectively (Liang *et al.,* 2018).

Sample collection

The faecal contents were collected and examined to detect of coccidian oocysts infection. The faecal contents were tested on the same day or stored in a chiller at 4°C for further analysis. The contents were first tested as described by Okoye (2009).

Determination of coccidian oocysts

Standard protocol was followed to determine the presence of coccidian oocysts. Floatation method was used based on Soulsby (1968); and Das *et al.* (2015).

Solution of 2.5 % potassium dichromate were mixed with faecal contents- which found positive for coccidian oocysts -in petri dishes and left at room temperature for sporulation. (Das *et al.,* 2015; Saikia *et al.,* 2017). Coccidia species were identified by their size and morphology as described by Saikia *et al.* (2017). Micrometry of oocyst was applied based on the procedure described by Zajac and Conboy (2012). The identification of each species was made based on the method of Saikia *et al.* (2017).

Data analysis

Data were analyzed using SPSS software version 20.0 (IBM Corp., Armonk, USA). Chi-square test was used to compare differences between infection at significant level of $p<0.05$.

Results

The total number of domestic pigeons was estimated to be 100, and the prevalence of infected coccidian was 72%. *Eimeria* spp. The oocysts were isolated in the test material was *E. labbeana.*

The oocyst was sub-spherical to spherical in the shape measuring about (16.5µm by 15.0µm) in size without micropyle, and the oocyst wall was thick and smooth and consisted of two layers. The shape of the sporozoites was curved, sporulated oocysts showed oocysts residuum and the time of sporulation was 24-48 hours. The oocyst sporulated and non-sporulated are shown in Figure 1.

Overall incidence of *Eimeria labbeana* infection

The findings of general average of *E. labbeana* infection among the tested birds are presented in Figure 2. The results obtained in the current study showed that the number of infected coccidiosis was 72% pigeons in males and females. The non-infected pigeons were 28% in both sexes.

Relationship of coccidiosis between male and female in domestic pigeons

The relationship of coccidiosis between male and female in domestic pigeons are showed in Table 1. The prevalence of coccidia was significantly (Chi square = 38.89, P = <0.0001) higher in female than that of males, where the total of infected females was 50 (69.4 %) and the number of infected males was 22 (30.6%).

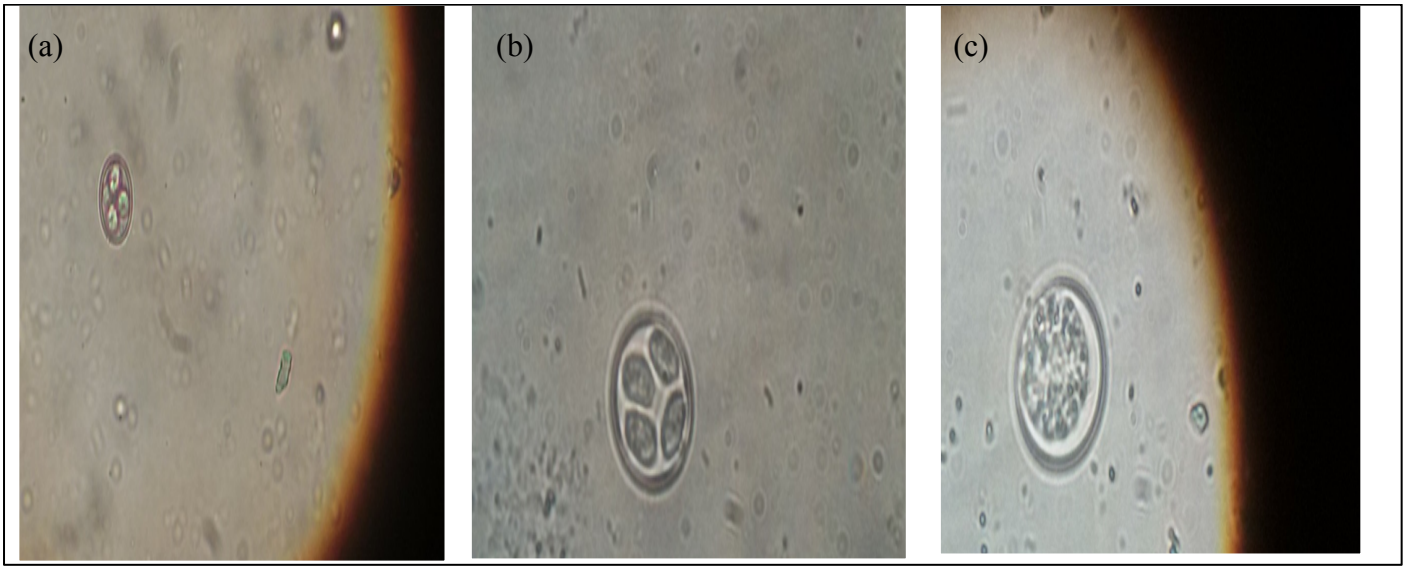

Figure 1. The oocyst sporulated and non-sporulated, a. Sporulated oocyst of *Eimeria labbeana* (X10), b. Sporulated oocyst of *Eimeria labbeana* (X40), c. Non-sporulated oocyst of *Eimeria labbeana* (X40).

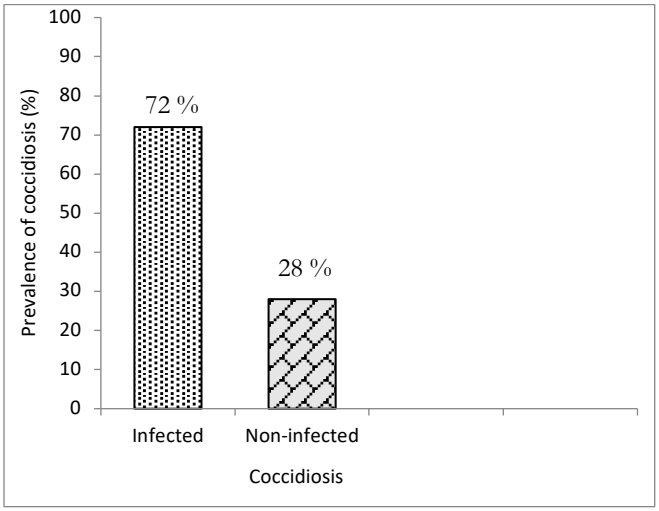

Figure 2. General average of *Eimeria labbeana* infection.

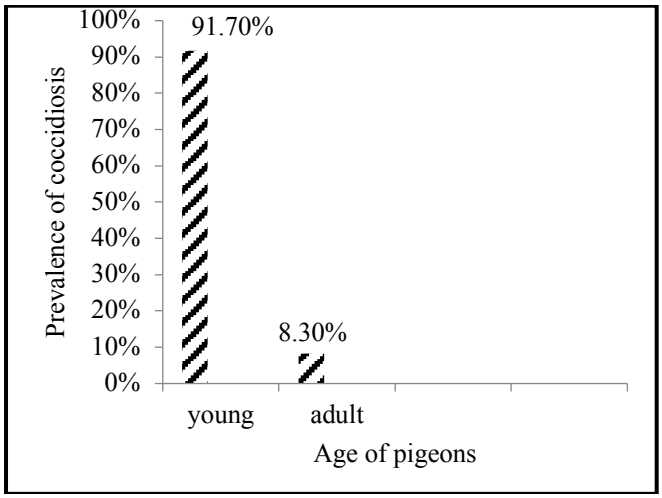

Figure 3. Prevalence of Eimeria labbeana in the young and adult domestic pigeons (Chi square = 75.49, P = <0.0001).

Prevalence of *Eimeria labbeana* in the young and adults domestic pigeons

The Prevalence of *E. labbeana* in the young and adult domestic pigeons was presented in Figure 3. The findings showed that the highest incidence of *E. labbeana* was observed in the young pigeons (Chi square = 75.49, P = <0.0001) rather than that of adults, where the total number of young pigeons was 66 (91.7 %), whereas the total number of the adult pigeons was 6 (8.3 %).

Table 1. Relationship of coccidiosis between male and female in domestic pigeons.

Sex	Infected pigeon	(%)
Male	22	30.60 %
Female	50	69.40 %
Total	72	100.00 %

Chi square = 38.89, P = <0.0001.

Discussion

The current study introduces for the first time study of coccidiosis in domestic pigeons in Benghazi city, Libya. Pigeon's coccidiosis may lead to diarrhoea and thirst, blood tinge, droppings, and marked intestinal inflammation with high mortality (Dalloul and Lillehoj, 2005; Bandyopadhyay *et al.*, 2006).

The findings are consistent with Mushi *et al.* (2000), who showed that coccidian oocysts were found to be 40% when they investigated the parasites of domestic pigeons (*Columba livia domestica*) in Sebele, Gaborone, Botswana. Avian coccidiosis is a

significant disease affecting poultry and lead to high economic losses in poultry industry, which acts as an important sector in the Egyptian national income. It affects domestic pigeons causing great losses (Gadelhaq and Habdelaty, 2019).

In the current study, *Eimeria* spp was observed to infect pigeons of all ages and sexes with an overall prevalence 72%. A similar findings were recorded in pigeons in the west Pomerania province of Poland; 74.14% (Balicka-Ramisz and Pilarczyk, 2014b), and in Owerri, Imo state, Nigeria (Opara *et al.,* 2012). It was reported by Opara *et al.* (2012) that the prevalence of *Eimeria* sp. In Nigeria was 28.6% in street pigeons. It was also mentioned that *Eimeria* sp. Was 33.3%, and 25% in males and females, respectively. Another study was carried out by Adriano and Cordeiro (2001) in the prevalence intensity of haemoproteus columbae on three species of wild birds from Brazil concluded that intensity of parasites were 100%, 51.6% and 19.3% in *Zenaida auriculata, Columbinae talpacoti* and *Scardafell squammata*, respectively. In the present study, the prevalence was higher in females than in males, where the total of infected females was 50 (69.4 %) and the total of infected males was 22 (30.6%). Similar results were mentioned by (Mohammed *et al.,* 2017), who referred that high prevalence was recorded in the province of Kano state, in Nigeria which was in females 20.83%, and males 18.06%.

The current results showed that the highest incidence of *E. labbeana* was occurred in the young pigeon rather than that of adults, where the total number of young pigeons was 66 (91.7%), and the number of adult pigeons were 6 (8.3%). Similar findings were referred to the high prevalence of coccidiosis in pigeons at different places worldwide (89 - 93% of young and 63-55% of adults (Mahdii, 2013; Balicka-Ramisz and Pilarczyk, 2014b; Joseph *et al.,* 2017; Mohammed *et al.,* 2017). The findings are in agreement with Krautwald-Junghanns *et al.* (2009), who pointed that coccidiosis is most commonly occurred in young pigeons and seldom found in adult birds. In addition, the prevalence of coccidiosis in pigeons worldwide was reported to be 36% in Germany, 71.9% in Slovenia, 50% in Belgium, Spain and 35.8% in Chicago, USA (Krautwald-Junghanns *et al.,* 2009). It is important to feed birds' diet containing small portions of soluble and insoluble fibres in order to improve the gut health and gut microflora. In a study conducted by Aguzey *et al.* (2020), who claimed that mannanoligosaccharides improve the small intestine of chicks in which increase the villi height, crypt depth and number of goblet cells per villus. The activities of these enzymes help in increasing the population of beneficial bacteria residing in the intestines of chicken. Similar observations were reported by Alshelmani *et al.* (2016) regarding the use of fermented palm kernel cake by cellulolytic bacteria referred to improve the gut microflora in broilers. In addition, supplementation of vitamin C may play an important role to increase the ability of birds against pathogens (Alshelmani *et al.,* 2020).

Conclusions

The prevalence of coccidiosis on domestic pigeons in Benghazi city, Libya was 72% among the investigated samples. In addition, the prevalence disease was observed in the young as well as the female pigeons. More studies are needed to investigate the intensity of infection as well as supplementation of feed additives to increase the gut health of the birds.

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