

Original Article**A Comparative Study of Parasitic Infections in Domestic and Wild Pigeons in Iraq****Dakheel Kremsh Alasadiy, Y^{1*}, Mukdad Mahmood, R², Najj Alhasnawi, A¹***1. Department of Biology, College of Education for Pure Sciences, Al-Muthanna University, Samawah, 66001, Iraq**2. Department of Biology, College of Education for Pure Sciences, Tikrit University, Tikrit, Iraq*

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Abstract

Parasitic infections in pigeons are very important due to their adaptability to different environmental conditions, as well as their relationship with human society. In this study, 250 samples of domestic and wild pigeons (*Columba livia*) were collected from different areas in Samawah, Al-Muthanna province, Iraq, from March 2020 to January 2021. Clinical examination of external parasites was conducted by screening fecal samples for intestinal parasitic infections and preparing direct swabs from the beaks. Out of the 250 pigeon samples (125 domestic and 125 wild pigeons), 65 pigeons were found infected (26%), including 40 domestic (32%) and 25 wild pigeons (20%) ($P \leq 0.05$). The results showed that these parasitic infections belong to three major groups of bird parasites: 1) Protozoa, such as *Eimeria* species (spp.) oocyst, *Cryptosporidium* spp., and *Trichomonas gallinae*, with prevalence rates of 21 (16.8%), 14 (11.2%), 19 (15.2%), 11 (8.8%), 7 (5.6%), and 2 (1.6%), 2) Helminths, such as cestodes (*Raillietina tetragona*) and nematodes (*Ascaridia columbae*) with prevalence rates of 5 (4%), 4 (3.2%), 4 (3.2%), and 2 (1.6%), as well as Arthropods, including lice (*Menacanthus stramineus*) with prevalence rates of 5 (4%) and 3 (2.4%) in domestic and wild pigeons, respectively. Additionally, no significant difference was found between male and female pigeons in their infection rate ($P \leq 0.05$). The findings also revealed that the highest percentage of infection in both genders of domestic and wild pigeons was caused by one spp. of parasites (62.5% and 64% in domestic and wild pigeons, respectively), followed by two spp. (24% and 27.5% in domestic and wild pigeons, respectively), and three spp. of parasites (10% and 12% in domestic and wild pigeons, respectively). However, there was no significant difference between domestic and wild pigeons regarding their infections with one, two, or three spp. of parasites ($P \leq 0.05$). It is thus concluded that differences in the prevalence of these parasites in different regions are partly due to differences in nutrition, feeding habits, and geographical environment.

Keywords: *Columba livia domestica*, Ectoparasite, Intestinal parasite, Iraq, Domestic bird, Wild bird**1. Introduction**

Domestic pigeons (*Columba livia domestica*) are closely related to humans and birds, they have been recently used as laboratory animals, and birds breeding is also a hobby for some people (1). In addition, wild pigeons are found in every part of the ecosystem environment, except for the Polar Regions (2).

Parasites can severely affect birds, such as pigeons

(*Columba livia*), by causing delayed growth, malnutrition, reduced egg production, immune system weakness, and death (3). Parasitic helminths disrupt gastrointestinal tract digestion and the absorption of foods (4). Microorganisms, such as bacteria, viruses, and parasites, as well as some factors, including nutritional deficiency management issues, can cause digestive problems in domesticated birds (5). Humans were

accidentally infected with parasites while breeding different types of birds, which caused complications, such as itching and severe allergies (6, 7).

Numerous investigations have been carried out to date on parasitic infections in countries around the world and different regions of Iraq, in particular (1-3, 8-14).

Therefore, this study aimed to find out the extent of infection with internal and external parasites in pigeons, including domestic and wild pigeons collected from different areas of Al-Samawah city in Al-Muthanna province, southern Iraq. Furthermore, by determining the percentage of infection with the detected parasites, it was determined whether there is a significant difference between the two types of pigeons (domestic and wild) regarding their gender (male and female).

2. Materials and Methods

2.1. Study Area

The study was conducted in Samawah, the capital and biggest urban center in Al-Muthanna province, Iraq, from March 2020 to January 2021. Samawah, Iraq, is the modern capital of Al-Muthanna province and based on the Köppen-Geiger climate classification system, it has a warm desert-like climate and most of its annual rainfall occurs in the winter. The average annual temperature in Samawah, Iraq, is 23.8°C (74.8°F). About 106 mm (4.17 in) of precipitation falls annually, with a latitudinal position of 31° 19' 55.13" N and a longitudinal position of 45° 17' 39.84" E. Samawah, Iraq, has a population of 152,890 people, based on the 2017 census (Statistics in Iraq population census, 2017, available at: <https://latitude.to/map/iq/iraq/cities/as-samawah>).

2.2. Pigeon Samples

The total number of birds studied was 250 pigeons collected from different parts of Samawah, Iraq. In total, 18 to 19 pigeon specimens were collected from all the areas under study per month using a handheld tour during the day. Afterward, the gender of pigeons was determined.

2.3. Isolation and Diagnosis of Parasites

After the pigeons were transferred to the laboratory, the following three steps were taken: 1) the clinical examination in which the external parasites were collected from different parts of the pigeons' bodies, such as feathers, skin, eyes, beaks, and legs, by using a magnifying glass and a dissecting microscope, 2) the preparation of direct swabs from the beaks, and 3) the examination of the gastrointestinal tract for the presence of oocysts and ovaries of parasites with fecal samples collected according to Methodology proposed by Natala, Asemadahun (9). The isolation, preparation, and staining of parasites were performed by methods used in the Manual of basic techniques for a health laboratory. Parasites were identified following the methodology proposed by Soulsby (15).

2.4. Statistical Analysis

Data were entered into an Excel file and then, were analyzed by the SPSS statistical software (version 20). Afterward, the types of internal and external parasite isolates and their prevalence were analyzed. Furthermore, significant differences in parasitic infections were investigated between domestic and wild pigeons using the independent sample t-test at ($P \leq 0.05$).

3. Results and Discussion

The findings revealed that out of the 250 examined pigeons (including 125 domestic and 125 wild pigeons), 40 domestic (32%) and 25 wild pigeons (20%) were infected (Table 1). In total, 65 pigeons (26%) were found infected during the period between March 2020 and January 2021 ($P < 0.05$). The difference in the prevalence of parasitic infection in domestic pigeons, compared to that in wild pigeons in this area may indicate that domestic pigeons can be more contagious due to the type of materials they feed on and their ability to facilitate the transmission of parasites to each other. On the other hand, the lower prevalence of infection in wild pigeons may be due to their habit of traveling long distances in search of food, which

reduces the abundance of intermediate parasite hosts. The results of the present study showed that there is infection with one species (spp.) of ectoparasites or several spp. of endoparasites.

The findings identified three major groups of bird parasites as the source of parasitic infections: 1) Protozoan, such as *Eimeria* species (spp.) oocyst, *Cryptosporidium* spp., and *Trichomonas gallinae*, with prevalence rates of 21 (16.8%), 14 (11.2%), 19 (15.2%), 11(8.8%), 7 (5.6%), and 2 (1.6%), 2) Helminths, such as cestodes (*Raillietina tetragona*) and nematodes (*Ascaridia columbae*) with prevalence rates of 5 (4%), 4 (3.2%), 4 (3.2%), and 2 (1.6%), as

well as Arthropods, including lice (*Menacanthus stramineus*) with prevalence rates of 5 (4%) and 3 (2.4%) in domestic and wild pigeons, respectively. Additionally, as can be seen in table 2, there was no significant difference between the two genders of domestic and wild pigeons ($P \leq 0.05$). Numerous studies previously reported different spp. of parasites in the body and intestines of birds in different parts of the world. Dehlawi (16) identified five spp. of Cestodes while examining seven wild pigeons (*Columba livia*) and one spp. of lice with total infection rates of 63 (38.8%) and 99 (61.2%), respectively.

Table 1. Percentage of infection in domestic and wild pigeons regarding their gender

Type of pigeons	Total number of pigeons examined	Number of pigeons infected with parasites (the percentage of infected pigeons)
Domestic pigeons	125	40 (32%)
Wild pigeons	125	25 (20%)
Total number (Total percentage of infection)	250	65 (26%)

Table 2. Prevalence of parasites depending on their type, collected from two types of pigeons

Types of parasites	Species of parasites	Number of positive prevalence of oocytes and ovaries of parasites No (%)	
		Domestic pigeons No (125)	Wild pigeons No (125)
Protozoan	<i>Eimeria</i> spp. (oocyst)	21 (16.8) (M:11.2, F:5.6)	14 (11.2) (M:8.8, F:2.4)
	<i>Cryptosporidium</i> spp.	19 (15.2) (M:8.8, F:6.4)	11 (8.8) (M:5.6, F:3.2)
	<i>Trichomonas gallinae</i>	7 (5) (M:1.6, F:4)	2 (1.6) (M:0.8, F:0.8)
Helminths	Cestodes	5 (4) (M:3.2, F:0.8)	4 (3.2) (M:2.4, F:0.8)
	<i>Raillietina tetragona</i>		
	Nematodes	4 (3.2) (M:2.4, F:0.8)	2 (1.6) (M:1.6, F:0.0)
Arthropods	<i>Ascaridia columbae</i>		
	Lice	5 (4) (M:2.4, F:1.6)	3 (2.4) (M:1.6, F:0.8)

In a study of 250 pigeons from slaughter slabs, Natala, Asemadahun (9) reported sources of parasitic infestation as follows: Protozoan parasites, including *Plasmodium relictum* (8%), *Haemoproteus columbae* (6.4%), *Leucocytozoon* spp. (15.6%), and *Eimeria* spp., as well as Helminth parasites, such as *Capillaria anatis*, *Ascaridia galli*, *Ascaridia columbae*, *Raillietina cesticillus*, *Raillietina tetragona*, *Raillietina echinobothrida* (0.8%, 1.2%, 1.2%, 3.0%, 4.9%, and 7.6%, respectively).

Radfar, Khedri (3) reported that 39 (84.78%) out of 46 birds (26 males and 20 females) have been infected with seven spp. of parasites, including endoparasites (two spp. of Cestodes and two spp. of Nematodes), as well as three other spp. of Ectoparasites, including *Raillietina tetragona* (26.08%), *Raillietina echinobothrida* (28.26%), *Ascaridia colombae* (15.21%), *Hadjelia truncata* (17.39%), *Argas reflexus* (13.04%), *Columbicola Columba* (41.30%), and *Menopen gallinae* (32.60%) in Sistan, Iran.

Nematollahi, Ebrahimi (10) reported that in Isfahan, Iran, 57 out of 100 (57%) Oropharyngeal swab smears were positive for *Trichomonas gallinae* and detected *Haemoproteus gallinae* in the blood smear of 62 pigeons (62%).

Badparva, Ezatpour (17) in a study conducted in Khorramabad, west of Iran, found a total prevalence rate of infection at 16.2% in 105 pigeons and detected the following four spp. of parasitic worms: *Ascaridia* spp., *Hymenolepis nana*, *Capillaria* spp., as well as *Raillietina* spp., with prevalence rates of 0.2%, 0.4%, 2.4%, and 4.2%, respectively. Furthermore, five Protozoan spp. were also found as follows: *Amoeba* spp., *Trichomonas gallinae*, *Histomonas* spp., *Eimeria* spp., and *Cryptosporidium* spp. (0.9%, 5.8%, 6.5%, 7.1%, and 7.3%, respectively). The results of the current study are in agreement to some extent with the findings of the study by Badparva, Ezatpour (17), which indicated that *Raillietina* spp. was the greatest prevalent helminth parasite (4.2%), and also showed that *Cryptosporidium* spp. was the most common

primary parasite (7.3%), followed by *Eimeria* spp. (7.1%).

Mohamed El-Dakhly, N. Mahrous (18) stated that in a total of 740 fecal samples from pigeons, the prevalence of Helminths was 11.76% and identified two trematodes (*Brachylaima cribbi* and unidentified *Brachylaima* spp. at 0.14% and 0.14%, respectively) and five cestodes (*Hymenolepis carioca*, *Cotugnia digonopora*, *Raillietina cesticillus*, *Raillietina tetragona*, as well as *Raillietina echinobothrida*, at 0.27%, 0.68%, 0.95%, 0.95%, and 4.46%, respectively). The most dominant cestodes spp. was *Raillietina echinobothrida* and the four nematodes spp. were *Capillaria* spp., *Heterakis gallinarum*, *Subulura brumpti*, as well as *Ascaridia columbae*, at 0.27%, 0.41%, 0.81%, and 3%, respectively. The highest prevalence of infection in the winter was found to be caused by trematode parasites, and in the summer, by cestode and nematode samples collected from Beni-Suef province, Egypt.

Chaechi- Nosrati, Eslami (19), in a study conducted in Lahijan, Iran, detected the incidence of four types of parasites in 180 wild pigeons with the nematode infection at 96%. It included three spp., namely *Acuaria spiralis*, *Capillaria obsignata*, and *Ascaridia columbae*, with infection rates of 7.6%, 34.4%, and 50%, respectively. Cestodes, such as *Raillietina echinobothrida*, *Raillietina tetragona*, as well as *Raillietina magninum ida*, were also detected at 45.4%, 45.4%, and 54.5%, respectively. Eight spp. of ectoparasites included *Dermanyssus gallinae*, *Menopen gallinae*, *Falculiferrostratus*, *Goniodes* spp., *Menacanthus stramineus*, *Megniniacubitalis*, *Pseudolynchia canariensis*, as well as *Columbicola columbae*, determined at 3.3%, 6.6%, 13.3%, 31.6%, 41.6%, 53.3%, 73.3%, and 88.3%, respectively. Finally, Protozoan spp., including *Trichomonas gallinae* and *Haemoproteus columbae*, were detected at 50% and 78.33%, respectively.

El-Dakhly, El-Seify (1) reported that 52.5% of pigeons in Aswan, Egypt, were infected by four spp. of

cestodes, including *Raillietina cesticillus*, *Raillietina tetragona*, *Cotugnia digonopora*, as well as *Raillietina echinobothrida* at 3.33%, 9.16%, 13.33%, and 22.5%, respectively, as well as one spp. of nematodes (*Ascaridia columbae* at 9.16%).

Cazorla Perfetti and Morales Moreno (20), in a study conducted in Coro, Falcon State, Venezuela, found that the prevalence of infection in birds was 54.3% (i.e., 280 out of 516), and that they were mainly infected by the following parasites: *Raillietina* spp., *Cyclospora* spp., *Isoospora* spp., as well as *Cryptosporidium* spp. with prevalence rates of 7.8%, 13%, 19.4%, and 38.5%, respectively.

Earlier studies indicated that the risk of infection with worms in the intestines of birds is due to their continued ingestion of infected excrement or intermediate hosts infected with living organisms, such as earthworms, cockroaches, grasshoppers, beetles, and flies (21). Stock management issues may occur as a result of infection with wild birds, which is generally less than domesticated birds.

Badparva, Ezatpour (17) reported that studies conducted in different regions of the world (i.e., Tanzania, Ethiopia, India, and Argentina) recorded a significant coccidiosis prevalence due to the availability of ideal conditions of humidity and

temperature, as well as suitable conditions for the reproduction of these parasites.

Jassim and Hadi (14) recorded two spp. of lice (*Columbian Cola* and *Menacanthus* spp.) in a study conducted in Baghdad, Iraq, on some spp. of pigeons.

The results of the present study on parasites were in agreement with the findings of studies by Dehlawi (16), Radfar, Khedri (3), and Khan, Gul (22).

The findings of the present study are also consistent with the results of previous studies on parasite spp. concluding that they could infect pigeons but at a smaller rate of prevalence. This may be due to the environmental conditions in Iraq, characterized by high temperatures and drought in most months of the year, causing a lack of appropriate conditions for the spread of parasitic infection.

As shown in table 3, the highest percentage of infection in both genders of domestic and wild pigeons was caused by one spp. of parasites (62.5% and 64%, respectively), followed by the prevalence of infection with two spp. (24% and 27.5%, respectively), and the prevalence of infection with triple spp. of parasites (10% and 12%, respectively). However, there was no significant difference between domestic and wild pigeons regarding infections with one, two, or three spp. of parasites ($P \leq 0.05$).

Table 3. Percentage of infection prevalence depending on the type of infection (one, two, or three species) in both genders of pigeons under study

Types of pigeons	Pigeons that were infected with one species of parasite %	Pigeons that were infected with two species of parasites %	Pigeons that were infected with three species of parasites %
Domestic Pigeons	62.5	27.5	10
Wild Pigeons	64	24	12

Badparva, Ezatpour (17) reported mixed infections in 5.7% of birds, while 94.3% had a single infection. Among the mixed infections, 33.3% had three spp. of parasites and 66.7% had two spp. of parasites.

In a study in Malakand region, Khyber Pakhtunkhwa, Pakistan, Khan, Gul (22) reported that 13 out of the 15 examined pigeons were infected and infested with three spp. of both ectoparasites and endoparasites, including lice (*Columbicola columbae* at 86.6%, *Campanulotesbidentatus* at 46.6%, as well as *Menacanthus stramineus* at 33.3%), cestodes (*Raillietina* spp. at 60% and *Cotugnia* spp. at 13.3%), and nematode (*Ascaridia* spp. at 16.66%). Ectoparasites infection by one parasite spp. (40%) was more prevalent, compared to two (13.33%) and three spp. (33.33%).

The results of the present study showed that the prevalence of parasitic infection in *Columba livia* (domestic and wild pigeons) was lower, compared to the results of other studies. Further studies are recommended on this background. The findings of the present study closely agree with other studies in Iraq and other regions of the world, especially concerning the spp. of parasites that infect domestic and wild birds. However, the prevalence rate of these parasites in the world is rather different from the results of the current study probably due to differences in nutrition, feeding habits, geographical changes that the region is exposed to, as well as environmental conditions prevailing in each region.

Authors' Contribution

Study concept and design: Y. D. K. A.

Acquisition of data: Y. D. K. A.

Analysis and interpretation of data: Y. D. K. A.

Drafting of the manuscript: R. M. M.

Critical revision of the manuscript for important intellectual content: R. M. M.

Statistical analysis: A. N. A.

Administrative, technical, and material support: Y. D. K. A.

Ethics

This study was approved by the Ethics Committee of the Biology College of Education for Pure Sciences, Al-Muthanna University, Samawah, Iraq.

Conflict of Interest

The authors declare that they have no conflict of interest.

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