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Study of Parasitic Infection and Its Histological Changes in a Bird

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ABSTRACT

Purpose: To investigate the histopathological aspect of the tissue in pigeons infected with parasites.

Materials and Methods: Pigeons were naturally infected with oocyst, worm ova and arthropod. This study was conducted from February to September 2013, on 125 (net trapped) wild pigeons living freely in the old obstructed tunnel (Rano) and rocks of Zakros Mountain, located on the road between Ilam and Aivan city, South West of Ilam province, Iran. Gizzard, liver, spleen, pancreas, esophagus, intestine, proventriculus, and tracheal glands were separated and preserved. Fresh fecal samples were examined and the Egg per gram was counted. Randomly, different tissues of 15 birds were collected and proceeded in Hematoxylin and Eosin for a histopathological study. The birds were checked for ectoparasites.

Results: Degenerative changes in the epithelial tissues of the esophageal and proventriculus glands as well as destructive changes in the esophagus, duodenum and cecum of infected pigeons were evaluated. A massive congestion was seen in the tissue of pancreas and trachea. The prevalence of Raillietina spp, Tetramers, Syngamus, Capillaria, Ascaridia columbae, oocyst of protozoa, Phthiraptera, Ceratophyllus Columbae contamination and multiples infection were 29%, 5%, 8%, 15%, 4%, 8%, 2%, 5% and 24%, respectively. Collected ectoparasites included feather lice (Phthiraptera) and pigeon fleas (Ceratophyllus Columbae).

Conclusion: The prevalence of different parasites in wild pigeons is somewhat different from racing and domestic pigeons in the same area, whereas it might be due to having different immune responses. Parasite infection could have some histopathological effects on different tissues, though few such reports exist to the best of our knowledge.

Keywords: birds; diseases; parasite; pathology; infection.

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INTRODUCTION

Pigeon serves as the host of a large number of endoparasites such as cestodes, nematodes and unicellular protozoa.[1,2] Helminthes infection exhibits severe effects on the host tissue.[3] Poultry industry is the most effective and economical source of animal protein in shortest possible time. Poultry producers are looking for some substitutes of chicken meat, which, in the future, will come in the form of pigeon and quail meat to contribute towards the increase in gross domestic production through livestock sector.[4,5]

Pigeon is probably one of the most common nuisance birds. Pigeons have adapted to living in the city, and they seem to be everywhere in urban environments. Unfortunately, the bird lovers feed them; therefore they have developed a dependence upon people, thus their dependency upon urban areas has been reinforced. They roost on signs, ledges, almost anywhere, and they bring

nesting material and leave droppings everywhere. Pigeons can carry or transmit encephalitis, histoplasmosis, Newcastle disease, pigeon ornithosis, cryptococcosis, pigeon coccidiosis, toxoplasmosis, pseudo-tuberculosis, and salmonella food poisoning. Pigeons can also carry fleas, ticks, mites and other parasites.[6-8]

It has been shown that birds harbor ticks, fleas, mites and other ectoparasites. The parasite bites an infected animal and sucks in blood containing the germ. When the bug bites, it passes along the germ to the new victim. This occurs because ectoparasites inject some of their saliva into the host when feeding. Over forty types of parasites live either on the birds or in the places they roost. They are responsible for the transmission of several hundred viral and bacterial agents. These diseases include plague, encephalitis, pox and meningitis. Control of these parasites is a crucial phase of the bird control project. Unless the parasites are exterminated when the birds are excluded from a site, the mites, fleas and ticks will seek to a new host, often the human inhabitants.[9-11] Therefore, a proper bird control project will always include parasite extermination. The most common worms found in pigeons are round worms, hair worms, stomach wall worms, strongly lids, and tapeworms. The symptoms vary with the type of infestation, and conceivably pigeons can live with slight infestations and show no signs of illness. Severe infestations generally cause droopiness, loss of weight and diarrhea. Tapeworms can cause breathing problems. The best way to determine the existence of worm problem is to check the droppings.[5,12-14]

The most common external parasites that pester our birds are feather lice, red mites, pigeon flies, and mosquitoes. Feather lice chew up holes into the flights or cause other types of visible damage to the feathers. The common red mite can be considered as a real problem if it becomes established. It commonly hides somewhere in the loft during the day and comes out from its hiding place at night to bite and feed on the blood of the birds. They can help spreading an assorting of diseases. The pigeon fly is probably the most dangerous parasite that can attack the birds. It lives most of its life on the pigeons, leaving only to lay its eggs somewhere in the loft. Pigeon flies bite the birds, cause considerable discomfort and may be a major cause of pigeon malaria. Mosquitoes would have to be considered the next worst parasite, which are found in almost all climates.[15] They are the most common carrier of pigeon pox virus. Since there is little report on wild pigeon and in order to continue and complete the previous study,[15] the aim of this study was to investigate the oocyst of protozoa, helminthes, and other endo/ecto-parasites contamination in the fecal samples and their pathological aspect on the wild pigeon tissue glands.

MATERIALS AND METHODS

This research was conducted to complete the previous research conducted by same researcher in the same area, from February to September 2013. A total number of 125 fresh fecal pigeon samples (at least 4 grams) were collected from a mixed companion of wild pigeons (net trapped) living freely in the old obstructed tunnel (Rano) and rocks of Zakros, the most famous mountain on the road between Ilam and Aivan city, Ilam province, southwest of Iran, in the lining border with Iraq country. Twenty five birds' specific pathogen free from same race were managed and tested in a hygienic environment. Care was taken as a controlling factor to avoid any contamination from outside. The samples were kept in an animal house, which was of a private sector farm located in an area named Sarab of Ivan. Pigeons were feed and watered at lab from the same ration and ingredient.

Data were collected using a questionnaire prepared according the number of the birds, deaths, sick birds, and race of them.

Diagnostic Methods

Fecal samples were immediately tested in laboratory and examined by direct smear method; whereas was counted by modified McMaster technique and centrifugal flotation method using Sheather's saturated sugar solution.[10] The ectoparasites were collected as described by Soulsby.[11] Briefly, after killing the pigeons using aesthesia, they were immediately placed in a polythene bag and the parasites were collected. The ectoparasites were preserved in 70% alcohol for identification purposes. Subcutaneous nodules of each bird were fixed in 10% potassium, heated for 20 minutes in a jar containing water, and then the sediments were looked for parasite.

Randomly, different tissues of 15 birds were collected and proceeded in Hematoxylin and Eosin for histopathological study. At first, portions of the esophagus, proventriculus, duodenum, jejunum, cecum and pancreas and trachea glands were fixed in 10% buffered formalin. Then, paraffin-embedded sections were cut at 6 µm thickness and stained with Hematoxylin and Eosin, finally examined under light microscope. Sections were photographed directly using a stereomicroscope in 400 ×with Microsoft system.

All the procedures were carried out in accordance with institutional guidelines for animal care and use.

RESULTS

Histopathology Report

The results showed that the livers of infected birds had fatty degeneration and areas of coagulative necrosis of the hepatic cells, most predominantly at the portal areas. There were mononuclear and polymorphonuclear cellular infiltrations in the necrotized areas. The liver had congested blood vessels and congested sinusoids. Histopathological changes including degenerative changes in the epithelial tissues of the esophageal (**Figure 1a, b**) and proventriculus gland (**Figure 2a, b**), as well as destructive changes in the epithelium of the esophagus (**Figure 1b**), duodenum and cecum (**Figure 3a, b**) were seen in the pigeon infected with different worms and protozoa. The lungs of the infected pigeons had hemorrhagic areas, congested blood vessels and Hemosiderosis. There was mononuclear and polymorphonuclear cellular infiltration at the peribronchiolar and interalveolar septae which was extended and filled some alveoli. The infected pigeons had necrosis of the intestines that involved the villi, intestinal glands and the muscularis mucosa of the intestines. There were mononuclear and polymorphonuclear cells in the necrotized areas.

Pancreas tissue in the pigeon infected with different worms and protozoa showed massive congestion in the pancreas parenchyma (**Figure 4**). The trachea in the

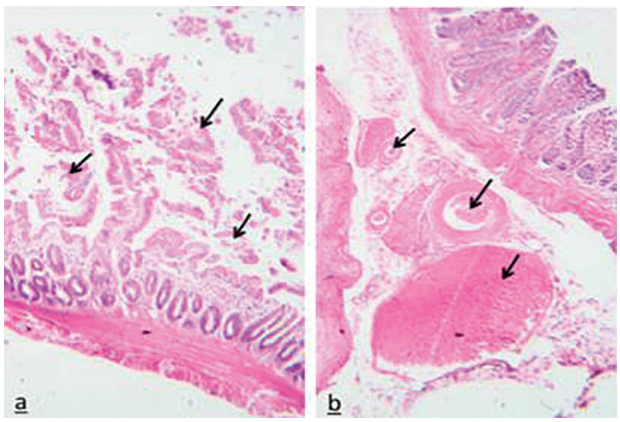

Figure 1. (a) Transverse sections of esophagus in the pigeon infected with different worms and protozoa. The section shows degenerative changes (arrows) in the epithelial tissues of the esophageal gland; (b) High magnification of the epithelium of esophagus in the pigeon infected with different worms and protozoa. The section shows destructive changes (arrows) in the epithelium of the esophagus. (a): × 200; (b): × 400; Hematoxylin and Eosin stain.

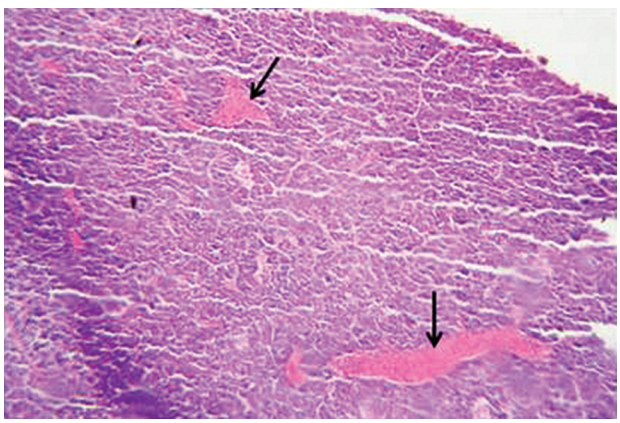

Figure 2. (a) Transverse sections of the proventriculus´s gland in the pigeon infected with different worms and protozoa. The section shows massive degenerative changes (arrows) in the epithelial tissues of the glands of proventriculus; (b) Transverse sections of the proventriculus in the pigeon infected with different worms and protozoa. The section shows massive congestion (arrows) in the adventitial layer of the proventriculus. (a), (b): × 400; Hematoxylin and Eosin stain.

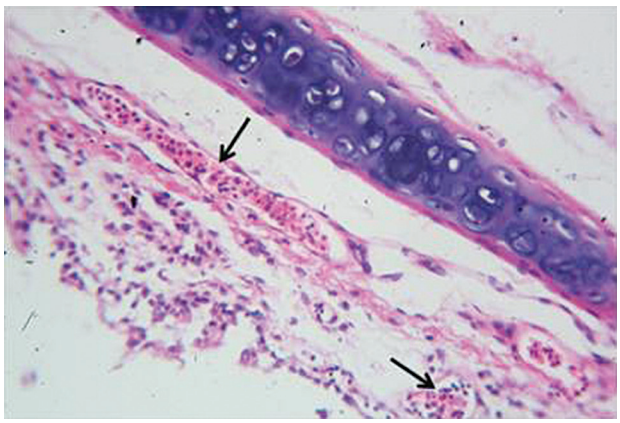

Figure 3. (a) Transverse sections of the duodenum in the pigeon infected with different worms and protozoa. The section shows massive degenerative changes (arrows) in the epithelial papillae of the intestine; (b): Transverse sections of the cecum in the pigeon infected with different worms and protozoa. The section shows massive congestion (arrows) in the sub-mucosal layer of the cecum. (a), (b): × 200; Hematoxylin and Eosin stain.

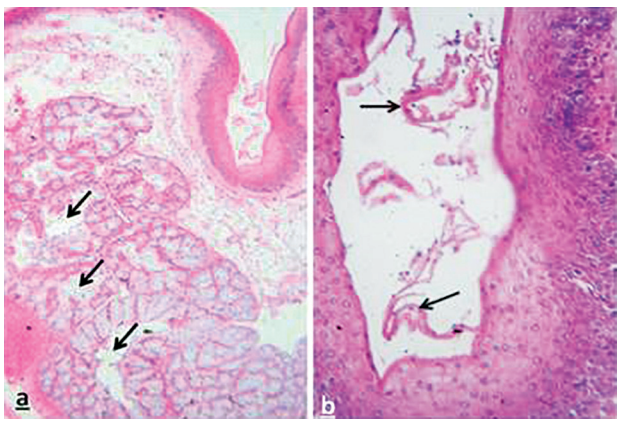

Figure 4. Transverse sections of the pancreas tissue in the pigeon infected with different worms and protozoa. The section shows massive congestion (arrows) in the pancreas parenchyma. × 200, Hematoxylin and Eosin stain.

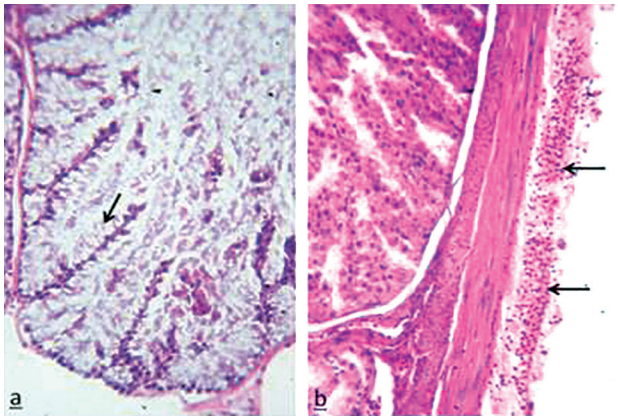

Figure 5. Transverse sections of the trachea in the pigeon infected with different worms and protozoa. The section shows local congestion (arrows) in the tracheal tissue. × 200; Hematoxylin and Eosin stain.

pigeon infected with different ecto/endo-parasites showed local congestion in the tracheal tissue (**Figure 5**).

Parasites Report

Out of 125 fecal samples, all were positive with at least one of the parasitic infections, while 24% were carrying multiple infections. Symptoms of worms consisted of weight loss and in the case of sever multiple worm infestation diarrhea was observed in the pigeon. Infected young birds grow slower. The parasites identified in this study include Raillietina spp 29%, Tetramers 5%, Syngamus 8%, Capillaria 15%, Ascaris 4%, Oocyst protozoa 8% and ectoparasites including feather lice (Phthiraptera, 2%) and pigeon fleas (Ceratophyllus columbae, 5%) (**Table 1**).

In this study, of the birds above two years, 30% showed more resistance against worms' infestation than young birds below two years 70%. The maximum and minimum environmental temperature of the area was set to 24°C and 36°C, respectively; also the maximum humidity was 2%.

Table 1. Types of parasite ovum in pigeon feces

Parasite	Percent
Raillietina spp	29
Tetramers	15
Syngamus	5
Capillaria	4
Ascaridia columbae	8
Oocyste	8
Phthiraptera	2
Ceratophyllus Columbae	5
Multiple infections	24

DISCUSSION

Bahrami and colleagues studied on intestinal parasitic species, composition, prevalence and intensity of infection in racing pigeon in the same area and reported the rate of Raillietina echinobothrida, Syngamus trachea, Capillaria columbae, Ascarididae columbae, Haemoproteus columbae, Trichomonas gallinae, Cryptosporidium spp and Eimeria sppas 10.4%, 8.4%, 6%, 8.4%, 20.8%, 26.8%, 1.2% and 21.6%, respectively.[8]

Totally 5 species of nematodes and cestodes were collected from alimentary canals including Raillietina, Tetramers, Syngamus, Capillaria, Ascaridia as well as oocysts of protozoa. According to the results of this study, an introduction of parasitological prophylaxis programs is necessary, especially in larger birds' farming and zoological shops. Radfar and colleagues reported Ascaridia columbae16.66%, Hadjelia truncata 1.96%, Cotugnia digonopora 13.79%, Raillietina magninumida 18.62%, Raillietina echinobothrida 32.35% from pigeons in South Khorasan, Iran.[16] Dandapat and colleagues reported that pigeons mostly suffered from Capillaria spp, Ascaridia columbae, and Coccidianoocysts. They also added that 22.40% of the pigeons population were found to be carrying Coccidian oocysts in their feces.[17]

In this study we collected ectoparasites included feather lice (Phthiraptera) and pigeon fleas (Ceratophyllus Columbae). Bahrami and colleagues reported ectoparasites including Lipeurus spp 3.2%, Menopen gallinea 15.2%, Ceratophyllus colombae 10.4%, and Louse fly 12% from the same area among racing pigeons.[8] In another study carried out from the same area by Bahrami and colleagues, the prevalence of Raillietina spp, Tetramers, Syngamus, Capillaria, Ascaridia columbae, Oocyst protozoa, Phthiraptera, Ceratophyllus columbae parasites ovum was confirmed in pigeons.[15] Radfar and colleagues reported 4 species of ectoparasites including Pseudolynchia canariensis, Columbicola columbae, Menopon gallinae and Laminosioptes cysticola from South Khorasan, Iran.[16]

The present findings represent more or less a similar pattern to that of the previous study by Msoffe and colleagues.[18] According to various studies performed in different regions of the world, Ascaridia columbae, Capillaria, Dispharynx, Hadjelia truncata, Syngamus and Tetrameres spp. were common identified parasites in pigeons.[19-21]

In the study carried out by Balakrishnan and colleagues, brood parasitic birds offer a unique opportunity to examine the ecological and evolutionary determinants of host associations in avian feather lice Phthiraptera.[9] Brood parasitic behavior effectively eliminates vertical

transfer of lice between parasitic parents and off spring at the nest, while at the same time provides an opportunity for lice associated with the hosts of brood parasites to colonize the brood parasites.[9] Thus, the biology of brood parasitism allows a test of the relative roles of host specialization and dispersal ecology in determining the host-parasite associations with birds and lice. If the opportunity for dispersal is the primary determinant of louse distributions, brood parasites and their hosts should have similar louse faunas. In contrast, if host-specific adaptations limit colonization ability, lice associated to the hosts of brood parasites may be unable to persist on the brood parasites despite having an opportunity for colonization. Balakrishnan and colleagues reported lice on four brood parasitic finch species genus Vidua.[9] The molecular phytogeny showed that lice infesting the two avian groups belong to two distinct clades within Brueelia. Likewise, distinct louse lineages within the Amblyceran genus Myrsidea were found on estrildid finches and the parasitic pin-tailed whydah Vidua Macroura, respectively. Although common on estrildid finches, Myrsidea lice were entirely absent from the brood parasitic indigo birds. The distribution and relationships between louse species on brood parasitic finches and their hosts suggest that host-specific adaptations constrain the ability of lice to colonize new hosts, at least those that are distantly related.

The histopathological effects particularly hemorrhagic lesions, which were observed in the esophagus, proventriculus´s gland, pancreas tissue, trachea and intestines, may be linked to the migration of the larvae during the tissue phase of the life cycle. It has been reported by Ikeme that adult worms migrated up and down the intestinal lumen, when present in large numbers and also aggregate in the lower half of the intestine, may cause intestinal obstruction and death of the affected pigeons. In severe infections, intestinal blockage occurred and chickens infected with a large number of Ascarids, suffered from loss of blood, reduced blood sugar content, increased urates, shrunken thymus glands, retarded growth, and greatly increased mortality.[22] Soulsby [11] and Adang and colleagues[23] reported that in many cases, the intestinal mucosa also reveals inflammatory lesions and focal hemorrhages caused by the burrowing of parasites. This confirms the results of the present study.

CONCLUSIONS

It is likely from the present study that helminthes and protozoa infections could have some histopathological effects on the pancreas tissue and proventriculus´s gland, though no such reports exist to the best of our knowledge. These are vital organs of the body and such effects on them could lead to high morbidity or mortality, secondary infections and even complicate the courses of other infections or diseases in domestic pigeons. Hereby, it is recommended to conduct some further research to ascertain any histopathological effects of helminthes and protozoa infection on different glands, in supporting of the present study. The result of this study indicated that the prevalence of ecto and endoparasites in wild pigeons is somewhat different from racing and domestic pigeons in the same area. Also, it could be concluded that the nature and physiological responses of the wild pigeons against some parasites are different and this could be due to immune responses of the birds in the wild. It is likely to conclude that helminthes and protozoa infections could have some histopathological effects on the pancreas tissue and proventriculus gland, though few such reports exist to the best of our knowledge.

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CONFLICT OF INTEREST

None declared.

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