



Research Article

Prevalence of Nematode Parasites in Different Birds with Histopathological Changes in the Intestinal Tissue of Common Quail (*Coturnix coturnix* L.) with Special Reference to *Heterakis gallinarum* Schrank, 1788

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Abstract | The present study was conducted to find out the prevalence of nematode parasites in different birds of Karachi, Hyderabad, Jacobabad and to find out the histopathological changes caused by *Heterakis gallinarum* in the intestine of common quail. The overall prevalence of nematodes parasitic infection was 7.48% while the overall intensity was 9.62. The histopathological study revealed complete destruction of villi and crypt glands. The intestine showed heavy infiltration of inflammatory cells. Increase in apparent size of villi with blunt and pointed ends was also observed.

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Keywords | Prevalence, Histopathological changes, Common quail, Nematode, *Heterakis gallinarum*



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Introduction

Helminths are macroscopic as well as microscopic parasites that can be easily seen with naked eyes in adult form. Infection with these parasites are found in almost every group of vertebrates including the birds acting as definitive hosts for the worms. All these worms are economically and medically important as these metazoans generate pathogenesis. More over a third of the globe's demographic is thought to be infested by one or perhaps more number of helminth parasites (Salazar-Castañon *et al.*, 2014).

Nematodes are an extremely diverse group of animals,

with estimates ranging from 100,000 to 100 million species (Hammond, 1992; Lambhead, 1993; Hugot *et al.*, 2001; Morand *et al.*, 2006). The majority of nematode species are free living and are found in every aquatic and moist terrestrial habitat (Convey and McInnes, 2005) while many are parasitic. Nematode parasites particularly large ones have multiple pathogenicity that includes mechanical damages to mucosa and submucosa, deformation of organs, inflammation, hemorrhage, blockage to the intestinal tract. Other than adult nematodes the migratory larvae cause various damages such as necrosis, hyperplasia, hyper anemia, fibrosis and inflammation at the site of migration. The present

study is performed to find out the prevalence and intensity of nematode parasites in different birds of Karachi, Hyderabad, Jacobabad and histopathological changes caused by *Heterakis gallinarum* Schrank, 1788 in the intestine of *Coturnix coturnix* L.

Materials and Methods

The birds were collected from 2016 to 2019 from Karachi, Hyderabad and Jacobabad. Birds were identified by using hand book of Birds of Pakistan (Roberts, 1991). The birds were dissected in Parasitological Laboratory, Department of Zoology, University of Karachi for examinations of nematode parasites. During internal examination each organ was suspected for all pathological signs of parasitic infections such as change in colour of organ, fluid contents, cysts, tumorous growth, colour and smell of intestinal content. Nematodes were recovered from the lumen of the small intestine. The specimens were transferred to the petri dish containing normal saline with the help of dropper or fine brush. The temporary mount of nematode parasites were made and examined under the microscope. Identification of nematode parasites was done according to Yamaguti (1961) and the relevant research papers for genus required.

For histopathological tissue samples from the infected part of the intestine were fixed in 10% formalin for twenty-four hours. Fixation is essential to maintain the tissue's molecular and structural composition and enhance the absorbance to prevent the staining procedure. After fixation, tissue is processed through dehydrated ethanol series, cleared in xylene, and placed for 24 hours in paraffin wax. The wax infiltrates the tissue's structure, increasing optical differentiation, hardening the tissue, and easier tissue sectioning.

Tissue was placed into cavity blocks then melted paraffin wax was applied to the tissue. 6-8 micron thick strips were produced using standard histology methods on slides. For extending the strips, the slides were placed on a hot plate set to 40°C-45°C. Then sections were stained with hematoxylin and eosin. The stainings were used to contrast the component sections of the tissue slice. Then, in each grade, went through a declining series of alcohol (100%-30%) for 5-8 minutes, followed by an ascending series of alcohol (30%-100%) for 5-10 minutes, cleared in clove oil and xylene and mounted with Canada balsam. Microphotographs of permanently mounted tissue slices were obtained with a Nikon photomicroscope.

Results and Discussion

The total 3286 birds were examined includes *Gallus domesticus* (Chicken), *Columba livia* (Rock dove), *Passer domesticus* (House sparrow), *Acridotheres tristis* (Common myna), *Coturnix coturnix* (Common quail) and *Alectoris chukar* (Chukor) and 246 birds found to be infected. 2368 nematode parasites belonging to six species were recovered from the intestine of birds of Karachi, Hyderabad and Jacobabad named *Ascaridia columbae* Gmelin, 1790, *Ascaridia galli* (Schrank, 1788) Pal and Ahmed, 1985, *Heterakis gallinarum* (Schrank, 1788) Pal and Ahmed, 1985, *Capillaria* spp. Zeder, 1800, *Cheilospirura hamulosa* Hussain, 1967 and *Diplotrriaena* sp. Railliet et Henry, 1909.

The overall prevalence of nematodes infection was 7.48% while the overall intensity was 9.62. Among Nematodes *Heterakis gallinarum* showed highest prevalence of infection i.e. 28.57% whereas *Heterakis gallinae* was recorded least prevalent species 2.36% (Table 1).

Table 1: Prevalence of nematode parasites in different birds of Karachi, Hyderabad and Jacobabad.

S. No.	Host	Parasitic spp.	Birds examined/infected	No. of worms	Prevalence %	Intensity
1	<i>Gallus domesticus</i>	<i>Ascaridia galli</i>	254/32	206	12.6	6.44
		<i>Heterakis gallinae</i>	254/6	25	2.36	4.17
2	<i>Columba livia</i>	<i>Capillaria</i> sp.	760/41	760	9.08	18.54
		<i>Ascaridia columbae</i>	760/61	1130	7.37	18.52
3	<i>Passer domesticus</i>	<i>Diplotrriaena</i> sp.	592/83	190	9.12	2.29
4	<i>Acridotheres tristis</i>	<i>Diplotrriaena</i> sp.	322/13	22	30.67	1.69
		<i>Capillaria</i> sp.	322/7	21	30.67	3
5	<i>Coturnix coturnix</i>	<i>Heterakis gallinarum</i>	7/2	10	28.57	5
6	<i>Alectoris chukar</i>	<i>Cheilospirura hamulosa</i>	15/1	4	14.29	4
Total			3286/246	2368	7.48	9.62

Histopathological changes in the intestine of common quail (Coturnix coturnix L.)

The histological structure of the quail's intestine is composed of a serosa, muscularis externa, submucosa, and a mucosa which forms villi that project into the lumen. Nematode infection causes enteritis. Current histopathological investigation revealed hemorrhages in mucosa throughout the length of intestine in case of high infestation and few patches in mild infection, degeneration of epithelial cells of the small intestine villi and crypt.

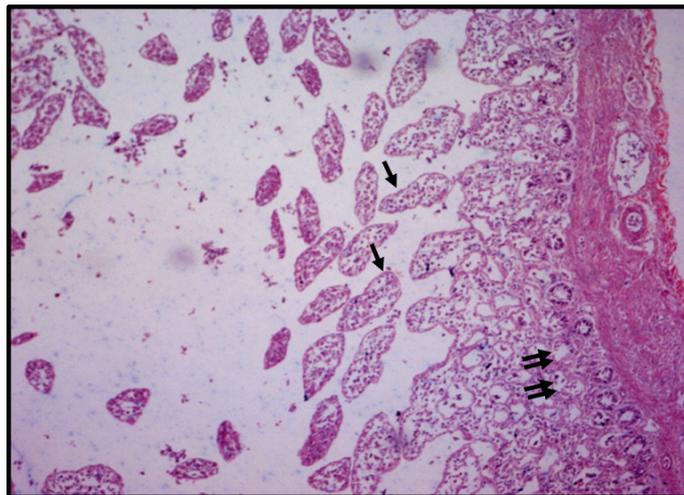


Figure 1: Photomicrograph of intestine showing congestion and fibroid formation of muscularis mucosa, extreme distortion of villi (arrow), crypt glands can be seen emptied (double arrow).

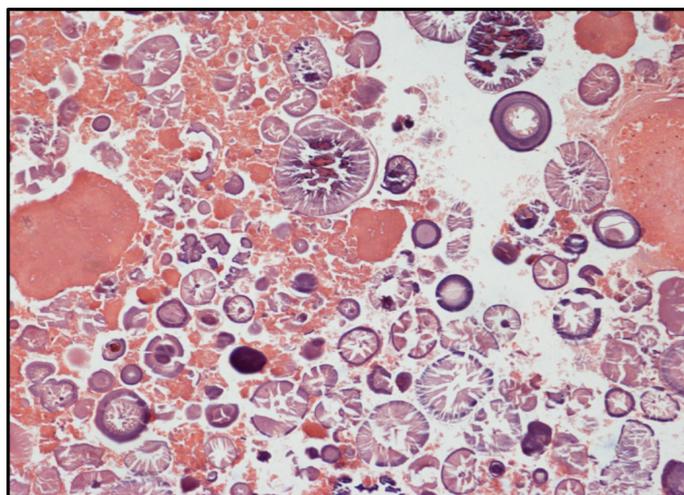


Figure 2: Photomicrograph showing a section of intestine with heavy infiltration of mononuclear inflammatory cells.

In [Figure 1](#) intestine showing congestion and fibroid formation of muscularis mucosa, extreme distortion of villi and crypt glands can be seen emptied. Section of intestine showing heavy infiltration of mononuclear

inflammatory cell in [Figure 2](#). The infected intestine showing an increase in apparent size of villi with blunt and pointed ends, shrinkage of serosa and muscularis mucosa along with necrotic patches can be seen visible and nerve plexus ([Figure 3](#)). In [Figure 4](#) intestine showing the vacuoles, large number of inflammatory cells and complete destruction of villi.

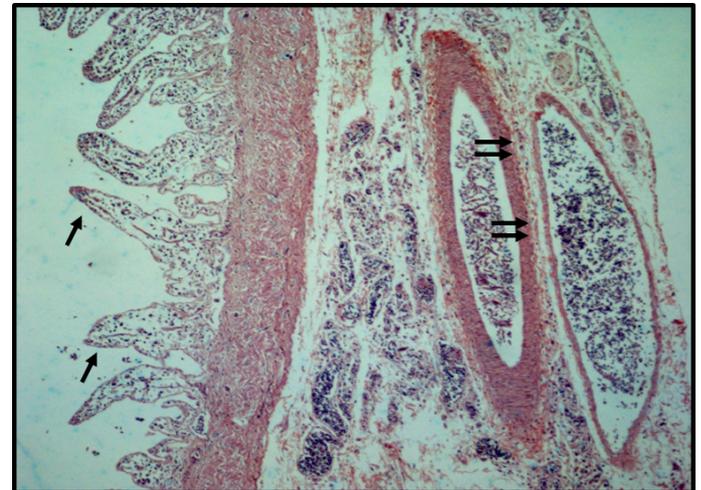


Figure 3: Photomicrograph of intestine showing an increase in apparent size of villi with blunt and pointed ends (arrow), shrinkage of serosa and muscularis mucosa along with necrotic patches can be seen visible and nerve plexus (double arrow).

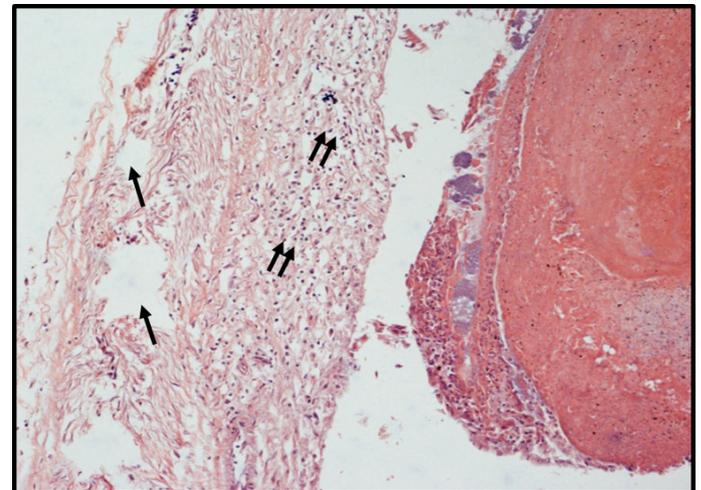


Figure 4: Photomicrograph showing the vacuoles (arrow), large number of inflammatory cells (double arrow) and complete destruction of villi.

According to the IUCN Red List, 23 percent of the world's birds are threatened or near-threatened with extinction, and 44 percent have declining populations. Bird extinctions and population reductions are already disrupting important ecosystem processes ([IUCN, 2014](#)). According to [Bahrami et al. \(2015\)](#) helminths affect vital organs of the body which could

lead to high morbidity and mortality. Radwan (2012) suggested that effects of helminths in birds might be manifested as reduction in their population. Qamar *et al.* (2017) suggested in his findings that a lot of pigeon deaths have been due to presence of parasitic infection, similar attribution is also given by Santoro *et al.* (2010) that 18.9% birds were considered to have died of parasitic diseases.

Present study is a part of the helminthological investigation of birds of three areas of Sindh, Pakistan, with the rate of prevalence of infection, intensity and pathological effects on cellular level due to parasitic infection.

Currently *Ascaridia columbae* reported from pigeon with prevalence rate of 7.37% while Nagwa *et al.* (2013) reported the same parasite in pigeons from Egypt with an infection rate of 12%. Marques *et al.* (2007) reported very high prevalence in Pigeon 92.85% from Brazil. Bushra *et al.* (2017) found new nematode species *Cyrnea columbi* sp. n. from *Columba livia*. *Ascaridia* spp. was reported 6.66% in a study conducted by Khan *et al.* (2018), they have worked on the parasitic infestation of domestic pigeons of Malakand region, Pakistan.

Currently *Ascaridia galli* found from chicken and its prevalence was 12.6% while Ola-Fadunsin *et al.* (2019) found the same species from poultry in Nigeria with the infection rate of 6%. Adang *et al.* (2014) reported prevalence of *A. galli* in Chicken 10.7% and in Ducks 0.7% from Nigeria. Ayshia and Wani (2015) observed 30.71% infection of *A. galli* in chicken from India. Hasan *et al.* (2018) found *A. galli* (21.67%) from game birds (Teetar, Budgerigar and Parrot). Gurung and Subedi (2018) reported 21.66% infection of *Ascaridia* in Pigeon from Nepal.

In present investigation *Capillaria* sp. was reported from pigeon and common myna with prevalence of 9.08% and 30.67%, respectively. Bahrami *et al.* (2012) observed *Capillaria columbae* 6% from pigeons in Iran.

Current findings reported *Heterakis gallinarum* from common quail with the prevalence of 28.57% and from chicken with the prevalence of 2.36%. Nagwa *et al.* (2013) found in Turkeys (7.1%) and Ducks (3.4%) from Egypt. Gurung and Subedi (2018) reported in Pigeon (2.50%) from Iran.

Ola-Fadunsin *et al.* (2019) found *A. galli* (6.0%), *H. gallinarum* (10.2%) and *Capillaria* sp. (0.8%) in chicken from Nigeria while Berhe *et al.* (2019) reported the same species from the same host with the prevalence of 68.84%, 74.26% and 51.45%, respectively from Ethiopia. Shaikh *et al.* (2016) reported *Heterakis* sp. (35.76%) and *A. galli* (32.11%) in chicken from Nigeria. Weir (2016) reported *A. galli* and *H. gallinarum* in natural laying hens. He concluded that *H. gallinarum* was more prevalent than *A. galli*. *Ascaridia* spp. and *Capillaria* spp. was found from Punjab, Pakistan with infection rate of 33.93% and 11.41% in captive birds by Akram *et al.* (2018).

In present study *Cheilospirura hamulosa* reported from the gizzard of Chukor; a national bird of Pakistan. The rate of infection was 14.29% while da Silva *et al.* (2016) found in chicken and Menezes *et al.* (2003) reported in Pheasants (14.3%) and chicken (26.7%) from Brazil. Ebrahimi *et al.* (2015) reported in Partridges from Iran with prevalence rate of 30%.

Diplotrriaena (Raillet and Henry, 1909) is specific parasites of birds found in thoracic and abdominal cavity, in mesenteries, entangled in the coils of intestine, around the heart and under the keel in the body of the birds (Bernardon *et al.*, 2016; Sood and Dang, 1977). In present study *Diplotrriaena* sp. was reported from House sparrow and the prevalence was 9.12%. Chandio *et al.* (2015, 2019) found *D. passerii* sp. n. from *P. pyrrhonotus* and *P. domesticus* and *D. monticolae* sp. n. from *P. pyrrhonotus* from Pakistan. The genus was also reported from other bird hosts outside the country but very less work has been done on prevalence. *D. manipoli* (10%) was reported from *Garrulus glandarius brandtii* by Hong *et al.* (2019). Rahman *et al.* (2019) suggested that helminth parasites induce severe histopathological changes in the intestine of birds which is also investigated during the present study. GIT of infected birds cause immune disturbance to the host leading to lethal effect. In present the intestines of common quail was infested with nematode parasites (*Heterakis gallinarum*) and the most affected parts observed was crypt glands and villi.

According to Hodges (1974) the small intestine of quail shares a similar structure to that seen in the chicken. During study it was observed that leaf like villi lost their connection with the lamina propria while same changes was also observed by Shaikh *et*

al. (2016) in *Columba livia*. There is heavy infiltration of macrophages due to *Heterakis gallinarum* infection, villi changed its size having blunted and pointed ends was also reported by Zghair *et al.* (2019) in Guinea fowl. The common findings were hyperplasia, inflammation, vacuolation, destruction of lamina propria were observed which has also been observed by Sheikh *et al.* (2016) in pigeon and Tsai *et al.* (1992) in passerine bird. Butt *et al.* (2016) described the pathology of chicken infected by *H. gallinarum* and observed the destruction of intestinal gland and necrosis of lamina propria.

Conclusions and Recommendations

There is not enough literature is available on the prevalence and association of helminth parasites with their avian host in Pakistan. Helminths are macroscopic as well as microscopic parasites found in almost every group of vertebrates including the birds acting as definitive hosts for the worm. All these worms are economically and medically important as these metazoans generate pathogenesis. Helminths affect vital organs of the body which could lead to reduction in their population, high morbidity and mortality. Further studies are required for the prevalence of helminth parasitic species and histopathological changes caused by them.

Novelty Statement

The present study would provide information about the prevalence of nematode parasites in different birds and intestinal damages caused by nematode *Heterakis gallinarum* worldwide in distribution in common quail. Common quail is economically important bird because both the bird and their eggs provide food for humans.

Author's Contribution

RM: Did collection and prepared the slides.

NK: Studied the histopathological slides.

SW: Prepared the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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