INVESTIGATION OF DIFFERENT PARASITES OF FARMED PIGEONS AT JOYPURHAT SADAR UPAZILA

A THESIS

BY

MD. MOSFIQURE RAHIM
REGISTRATION NO.: 1705447
SEMESTER: JULY - DECEMBER, 2018
SESSION: 2017-2018

MASTER OF SCIENCE (MS)
IN
PARASITOLOGY

DEPARTMENT OF PATHOLOGY AND PARASITOLOGY
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

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Approved as to the style and contents by

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(Dr. Md. Golam Azam)	**(Prof. Dr. Md. Nazrul Islam)**
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DEPARTMENT OF PATHOLOGY AND PARASITOLOGY
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

DECEMBER-2018

DEDICATED

TO MY

BELOVED PARENTS

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ABSTRACT

The main objectives of the present study were to investigate the prevalence and intensity of various infections from both sexes pigeons are commonly or frequently infected with endo and ectoparasite. A total of 140 birds (pigeon) were observed and collecting sample from them on different village of sadar upazila of Joypurhat district from July to December, 2018. The samples are composed of 58 males and 82 females where 46 young and 94 adult. 4 ectoparasite (*Menacanthus* sp., *Lipeurus* sp., *Menopon* sp. and *Columbicola columbae*), 5 helminth (*Heterakis* sp., *Capillaria* sp., *Ascaridia* sp., *Raillietina* sp. and *Echinostoma* sp.) and 2 protozoan (*Trichomonas* sp. and *Eimeria* sp.) are recovered from the sample by using different technique. Overall prevalence of helminth 76.42%, protozoa 33.57% and highest prevalence in ectoparasite 90.71%. The adult are more susceptible to infection, where the overall prevalence rate of adult 81.12% at (0.001) statistically significant and ectoparasite 73.40% at P-value (<0.001). But in young are significantly lower 39.13% susceptible than adult. The sex related prevalence in helminth 81.70% at P>0.05 than in male and ectoparasite 82.29% at P>0.05. But in male only protozoan are susceptible than female that prevalence in 29.31%. It is statistically significant at P<0.001 and also during postmortem examination blockage found in intestine. However the outcome indicate that this areas of pigeons are more susceptible to infection and infestation, it may be due to bad nurturing practice, climatic condition, geographical location, which may great economic damage of farmer as well as loss of the GDP of country.

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LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
BLRI	Bangladesh Livestock Research Institute
%	Percentage
Sp	Species
SPSS	Statistical Package for Social Science
et al.	Associates
N	Number
NS	Not Significant
SE	Standard Error
>	Greater than
<	Less than
=	Equal

CHAPTER 1

INTRODUCTION

Bangladesh is one of the high density countries of the world has a population of 160 million people within the area of 1,47,570 square-km. About Eighty percent people of this country still live in villages and are extremely poor. The poultry sub-sector is an important avenue in fostering agricultural growth and reduce malnutrition for the people in Bangladesh (Rankin *et al.,* 2014). It is an integral part of farming system in Bangladesh and has created direct, indirect employment opportunity including support services for about 6 million people (Ansarey *et al.,* 2012). This sub-sector has proved as an attractive economic activity, thereby, indicating its` importance for the entire economy. The sector accounts for 14% of the total value of livestock output and is growing rapidly (Raihan *et al.,* 2008). It is find out that poultry meat alone contributes 37% of the total meat production in Bangladesh. Poultry contributes about 22-27% of the total animal protein supply in the country (Prabakaran *et al.,* 2003). Development of poultry has generated considerable employment through the production and marketing of poultry and poultry products in Bangladesh. Poultry producers are searching for some substitute of meat, which will come in the form of pigeon meat to contribute towards the increase in Gross Domestic Production (GDP) through livestock sector.

Pigeons are reared in Bangladesh from the time immemorial. The weather and vast areas of crop field along with housing premises of Bangladesh are suitable for pigeon farming. Mankind has practiced pigeon keeping for about 10,000 years in almost every part of the world (Levi, 1977). Pigeon is the first bird species to have been treated by humans (Johnston and Janiga, 1995).

Pigeons are not aristocratic bird but its body shape, colorful feathers, ornamentation, care, mode of breeding; availability and cost seem to be aristocratic. From the very beginning of human welfare there existed a good relation between pigeon and human. At the dawn of human civilization pigeons are used as letter sending. Later on its tumbling is another great point for its peculiar life. These birds are more social, lovely and sophisticated and found most of the houses in rural and urban areas (Kabir, 2015).

Pigeons are a source of food, used as pets, and are cultural and religious symbols. They also make good laboratory animals, for instance in diagnosis of fowl cholera (Cooper, 1984). Therefore, the importance of pigeons can not be overemphasized. The veterinary relevance of pigeons has been reviewed in detail by Cooper (1984) and Zwart (1986, 1993).

Domestic pigeons (*Columba livia* domestica) are the most successful pet birds adapted to human habitation worldwide. As a pet bird, pigeons are considered to be attractive and raised from long period of time as a religious or cultural symbol. Being a pet bird, the interaction of pigeons with man and other wild and domestic birds makes them a potential carrier of zoonotic parasites and serves as a source of infection to human and other birds/animals such as being a reservoir of many infectious pathogens which largely affects specially poultry industry by means of transmitting disease to flocks (Cooper, 1984).

The close contact of pigeons with other domestic birds increases risk of parasitic infestation in birds and carries a possible zoonotic potential for transmission of diseases to human beings (Cooper, 1984; Kaminjolo *et al.*, 1988; Piasecki, 2006; Marques *et al.*, 2007; Sari *et al.*, 2008). The diseases are mainly spread through faecal dust from cages contaminated with dry droppings and urine (Marques *et al.*, 2007).

Pigeon of the order Columbiformes are ubiquitous bird and can be found in virtually every town and city around the world (Marques *et al.*, 2007). Pigeons have been accompanied by human since ancient time. They live side by side with human as a source of food, hobby and experimental purposes (Sari *et al.*, 2008).

Several health problems can affect pigeon where ecto– and endo–parasitic infections play a major role (Marques *et al.*, 2007). Among different gastrointestinal (GI) helminthes, nematodes are the most deleterious parasites responsible for occurrence of clinical and sub–clinical parasitic diseases.

The prevalence and intensity of parasitic infestations may be influenced by a number of epidemiological factors including host factors such as age, sex, breed and environmental factors such as climatic conditions (Iqbal *et al.*, 2007).

The following objectives of the present study in my research:

1. To inquiry and identify various parasites of pigeon.
2. To detect the prevalence of parasites according to age and sex of pigeons.
3. To know the exorbitance or intensity of parasites in pigeon.
4. To collected affected GIT for gross lesions

CHAPTER 2

REVIEW OF LITERATURE

2.1 Prevalence of parasitic diseases in pigeon

Abed *et al.*, (2014) examined blood samples for blood parasites, oral cavity and intestine examined for *Trichomonas* and helminthes respectively in 95 pigeon obtained from local market of Al-Dewniya city and recorded 29.47% with blood parasites (*Haemoproteus* spp.), 66.31% pigeons were parasitized with tape worms 19(20%) belongs to *Cotugnia* spp and 46.31% belongs to *Raillietina* spp. 38.94% with nematodes (*Ascaridia* spp.), 10.52% with *Trichomonas* and 7.36% apparently clean.

Adang *et al.*, (2008) reported five species of ectoparasites in 177 (73.8%) pigeons among 240 (127 males and 113 females) domestic pigeons. The ectoparasites comprised lice: 6.3% *Menopon gallinae*, 63.8% *Columbicola columbae* and 10.8% *Goniodes* sp.; flies: 37.1 *Pseudolynchia canariensis* and 2.5% of mites (*Dermanyssus gallinae*). 30.8% of the domestic birds had single infestation, 39.6% had double infestation and 2.9% had triple infestation. The difference between single and mixed infestation was not statistically significant (P>0.05). The females had a higher prevalence (74.3%) than the males (73.2%). There was however no significant difference (P>0.05) in the infestation rates between the sexes. Ectoparasites were removed from the birds throughout the year with highest prevalence (95%) in August. *Columbicola columbae* and *Pseudolynchia canariensis* were collected throughout the year.

Adang *et al.*, (2009) examined a total of 30 (20 males and 10 females) Speckled Pigeons trapped from the wild in Zaria and its environs, Nigeria, for ectoparasites and intestinal helminths, to determine the prevalence, intensity and mean intensity of infestation and infection and reported eighteen (60.0%) of the birds were infested by three species of ectoparasites as follows 56.7% *Menopon gallinae*, 60.0% *Columbicola columbae* and flies: 30.0% *Pseudolynchia canariensis*. Single, double and triple infestations were found in 3.3%, 26.7% and 30.0% respectively, though the difference was not significant (P>0.05). The sex-specific infestation rate was 60.0% in males and 60.0% in females. 56.7% birds were infected by helminthes represented by four species of cestodes recovered from the gastrointestinal tract. The cestodes were represented by *Raillietina* (3.3%), *Raillietina cesticillus* (26.7%), *Amoebotaenia cuneata* (13.3%) and *Hymenolepis*

carioca (13.3%). Single infection was the only infection type observed. The sex-specific rate of infection was 55.0% in males and 60.0% in females.

Al-Rammahi *et al.*, (2013) carried out a research in Babylon province on 138 domestic and wild columbide birds were collected during the period from April to June 2012 and recorded the highest rate of infection with Trichomonus gallinae, in wood pigeon 53.33% followed by Rock pigeon, Domestic pigeon, collared dove and palm dove 40%, 30%, 13.34% and 11.12% respectively. The results revealed that the total rate of infection was 80 (57.97%), with cestodes parasite. A significant differences regarding the type of the birds, the highest prevalence was recorded in wood pigeons 90% followed by rock pigeon, collared dove and domestic pigeons in prevalence rate 83.34%, 40% and 26.67% respectively, while no cestodes recorded in palm dove. A significant differences regarding the type of cestodes parasite. Out of 123 collected cestodes, 64.23% were geuns *Raillietina*, (18.69%) were geuns Aporina and (17.07%) were geuns *Cotugnia*.

Bahrami *et al.*, (2011) examined 250 faecal samples of pigeon by direct smear method whereas egg per gram (EPG) was counted by modified McMaster technique and centrifugal flotation method using Sheather's saturated sugar solution and recorded*Raillietina* spp. (24%), Tetramers (8%), Sygnamus (9%), *Capillaria* (14%), *Ascaridia colombae* (4%) and *oocyst* of protozoa (7%), Phthiraptera (8%), Ceratophyllus *columbae* (6%).

Bahrami *et al.*, (2012) carried out an experimental study from May to September 2011 on 250 (168 adults and 82 nestlings) blood and faecal samples randomly collected from suspected pigeons (mostly young) and 25 specific free pathogen birds as control and observed prevalence rate of various helminthes including *Raillietina echinobothridia* (10.4%), *Syngamus* trachea (8.4%), *Capillaria colombae* (6%) and *Ascaridia colombae* (8.4%). and some porotozan infections including *Haemoproteus colombae* (20.8%), *Trichomonas gallinae* (26.8%), Cryptosporidium sp. (1.2%) and *Eimeria* sp. (21.6%) and also ectoparasites including Lipeurus sp. (3.2%), Menopen *gallinae* (15.2%), Ceratophyllus *colombae* (10.4%) and Louse fly (12%).

Bahrami *et al.*, (2013) examined 250 faecal samples of pigeon by direct smear method, modified Mc Master technique and centrifugal flotation method and recorded the parasitic diseases as *Raillietina* spp, Tetramers, Sygnamus, *Capillaria*, *Ascaridia colombae* and *oocyst* of protozoa, Phthiraptera, Ceratophyllus *columbae* and the

frequency as 24.24%, 8.08%, 9.09%, 14.14%, 4.04%, 7.07%, 8.08% and 12(6.06%) respectively and 19.19% of pigeon had multiple infection. They also found that the birds above two years (41.91%) show more resistance against worms' infestation than young birds below two years (58.08%).

Bahrami *et al.*, (2013) examined fresh faecal samples of pigeons by direct smear method whereas egg per gram (EPG) was counted by modified Mc Master Technique and centrifugal flotation method using Sheather's saturated sugar solution and recorded *Raillietina* spp., Tetramers, Sygnamus, *Capillaria, Ascaridia colombae* and *oocyst* of protozoa, Phthiraptera, Ceratophyllus *columbae* as 29%, 5%, 8%, 15%, 4%, 8%, 2% and 5% frequency respectively.

Begum and Sehrin (2012) reported eleven species of helminth parasites: four species of trematoda: *Echinostoma revolutum* (15%), *E. trivolvus* (5%), *Patagifer bilobus* (5%), *Ehinoparyphium recurvatum* (8.33%); six species of cestoda: *Hymenolepis columbae* (63.33%), *Raillietina echinobothrida* (100%), *R. bonini* (43.33%), *R. cesticillus* (100%), *Cotugnia* celebesensis (68.33%), *C. cuneata* (100%) and one species of nematoda: *Ascaridia columbae* (28.33%) in 60 pigeon, *Columba livia* (25 males and 35 females). Females showed slightly higher intensity of infestation than the males.

Begum *et al.*, (2008) examined 300 pigeon during July 2007 to June 2008 in different areas of Mymensingh district. Prevalence of *Trichomonas gallinae* was higher in female pigeon (70.9%) than male pigeon (63.8%). Adult pigeons aged >3 months were comparatively more affected (75%) than the squab aged <30 days (72.1%) and the younger aged between 30 days to 90 days (64.7%). *T. gallinae* infection was significantly ($P<0.01$) lower in summer (48.4%) than rainy (69.8%) and winter (69.3%) seasons.

Begum *et al.*, (2011) recorded 10 species of ectoparasites in 60 pigeons, *Columba livia* (25 males and 35 females). The ectoparasite comprised lice: 100% *Menopon gallinae*, 46.66% *Menacanthus stramineus*, 71.66% *Colpocephalum turbinatum*, 100% *Columbicola columbae*, 51.66% *Lipeurus caponis*, 31.66% *Goniocotes gallinae*, 46.66% *Chelopistes meleagridis*; fleas: 8.33% *Echidnophaga gallinacean*; flies: 63.33% *Pseudolynchia canariensis* and 13.33% of mites *Dermanyssus gallinae*. Serious damage was observed in wing feathers (31.74%). The females had a higher intensity (30.11) of infestation than the males (29.04). The ectoparasites were removed from the pigeons

throughout the year. The overall intensity of infestation was highest during summer (40.69) and lowest during winter (21.94).

Dadi-Mamud *et al.*, (2012) examined 50 Columbia livia for the presence of haemoparasites in 2010 in lapai Niger State Nigeria, through the use of blood smears stained with giemsa stain and recorded 78% of the birds were infected with one or more haemoparasite belonging three genera *Haemoproteus*, plasmodium and *Leucocytozoon*. Some of the birds were singly infected while others had multiple infections. For the single infection, plasmodium (30%), *Haemoproteus* (14%) and *Leucocytozoon* (4%) and for the double infection, *Haemoproteus* and plasmodium (14%), *Haemoproteus* and *Leucocytozoon* (4%) and plasmodium and *Leucocytozoon* (4%) while for triple infection it was (8%).

Dey *et al.*, (2010) found that 44% pigeons were infected with blood protozoa, *Haemoproteus* sp. (20%) and *Leucocytozoon* sp. (24%) among 75 pigeons from different areas of Mymensingh district of Bangladesh during July to December, 2007 which was higher in male (28%) than female birds (16%) and male pigeons were 2.57 times more susceptible than the female pigeon.

Doosti *et al.*, (2014) determined the prevalence of *Haemoproteus columbae* in Iranian pigeons by examining blood sample of 220 pigeons from September 2012 to April 2013obtained from wing vein by a molecular technique (PCR) and reported that the prevalence rate of *Haemoproteus columbae* was 23.18%.

Dranzoa *et al.*, (1999) examined 34 pigeons to investigate parasites from October, 1996 to March, 1997 and recorded the ectoparasites, *Pseudolynchia canariensis* was the most prevalent parasite (100%) followed by *Columbicola columbae* (94.1%) and *Menopon gallinae*, *Menacanthus stramineus* and *Chelopistes meleagridis*, cestodes (23.5%) and *Haemoproteus* (76.5%).

Eljadar *et al.*, (2012) carried out a study to determine endo-parasites in green mountain region from free range pigeons by the examination of fecal samples using the salt flotation technique and blood samples stained with Giemsa collected from different pigeons species and evaluated for the presence of gastrointestinal parasites and heamoparasites. Protozoa (90% for *Eimeria* spp. and 1% for *Haemoproteus* spp.) and nematodes (20% for *Capillaria* spp. and 10% for *Heterakis* spp.) were detected in

number of the cases, whereas 5% of the fecal samples were infected by multiple parasites. The presence of coccidian oocysts was revealed in the most of fecal samples.

El-Khatam and Laila (2016) confirmed *Trichomonas gallinae* infection in infected birds by microscopical examination of oral swabs, histopathological examination, and PCR of the ITS1/5.8S/ITS2 gene among 3315 pigeons of different ages from the Minoufiya governorate. The prevalence was 1.9%. The parasite was found 2.04% from Ashmoun, 1.66% from Minoof, 1.6% from Quesna, and 2.5% from El-Shohada birds. The infection was mainly detected in squabs 1.8%. The sequence of *T. gallinae* ITS1/5.8S/ITS2 gene from Egypt has high nucleotide sequence identity (up to100%) to *T. gallinae* from pigeon of USA, Austria, Canada, and Spain. The sequence belongs to genotype B of *T. gallinae*.

Ghosh *et al.*, (2014) examined a total of 100 pigeons for the presence of ecto and gastrointestinal (GI) parasitic infections) in Chittagong Metropolitan area, Bangladesh. He recorded the overall prevalence of ecto–parasitic infestation and gastrointestinal parasitic infections were 67% and 72% (single or mixed) respectively. Among 6 different ecto–parasites, the highest infestation was caused by *Pseudolynchia canariensis* (43%) followed by *Lipeurus caponis* (28%), *Goniodes gallinae* (28%), *Menopon gallinae* (13%) and pediculosis were a common problem. Further, adult pigeons (86%) were more prone to ecto–parasitic infections in compare to squabs (48%), which was statistically significant ($P<0.05$). Among six different species, the highest prevalence was recorded for *Ascaridia galli* (35%) followed by *Capillaria* sp. infection (22%). Adults (74%) were more susceptible to GI parasitic infections in compare to squabs (70%) but it was not statistically significant ($P>0.05$).

Islam *et al.*, (2013) conducted an exploratory study from January, 2006 to December, 2006 in different areas of Netrokona and Mymensigh district to determine the presence of *Haemoproteus* spp. in different types of birds. Blood samples were collected from the veins of 57 pigeons (*Columba livia*), 30 chickens (*Gallus gallus* domesticus), 50 ducks (*Anas platyrhynchos* domestica) and 32 quails (*Coturnix japonica*) and smears were prepared. Of all the examined birds, 23.3% (7/30) chickens, 50.9% (29/57) pigeon and 12.5% (4/32) quails were found to be infected with *Haemoproteus* spp. Highest presentage of *Haemoproteus* spp. was observed among older bird in case of both chicken

(13.33%) and pigeon (33.33%). Out of 57 pigeon 31.58% female and 19.3% male were tested positive for *Haemoproteus* spp. infection.

Khezerpour and Naem (2013) examined a total of 138 pigeons to evaluate the prevalence and distribution of helminthes parasites of pigeons from May 2011 to March 2012 in different parts of Urmia, Western Azerbaijan, Iran and recorded 23.18% overall parasite prevalence in pigeons with specific prevalence for *Ascaridia columbae* being 13.04% followed by species of *Raillietina echinobothrida* (10.14%), *R. tetragona* (2.89%), *R. magninomida* (1.44%) and *Capillaria* spp. (0.72%). The infection rate infemale and male pigeons was 65.62% and 34.37% respectively which had significant differences ($P<0.01$). No trematode infection was detected. Highest prevalence of infection was in spring and winter. Among all examined organs jejunum had maximum infection density especially with *R. echinobothridia* and *A. columbae*. Single infection was more common (18.84%) than double (3.62%) and triple infections (0.72%).

Layla *et al.*, (2016) carried out a study to detect the prevalence of parasitic infection among (38) domesticated pigeons (*Columba livia*) and found that 29 (76.3%) pigeons were infected with intestinal parasites and the incidence rates were 5.3% in younger and 71.1% in adult pigeons. The highest rate of helminthic infection about (72.4%) following (48.3%) of infection with protozoa and 20.7% mixed infection with helminths and protozoa. Furthermore, the nematodes (65.5%) were more infected in pigeons compare with cestodes (31%). *Capilliaria columbae* (28.6%), *Ascaridia galli* (16.7%), *Raillietina cesticillus* (14.3%), *Cotugnia digonophora* (7.14) and *Eimeria oocyst* (33.3%) were identified.

Marques *et al.*, (2007) conducted a study to determine the prevalence of ectoparasites and endoparasites in 58 free-living pigeons (*Columba livia*) in urban areas of Lages, in the state of Santa Catarina, Brazil. The blood samples were examined through the use of blood smears stained with Quick Panoptic and Giemsa methods and fecal samples of pigeons were analyzed using Sheather's method. The Quick Panoptic and Giemsa methods detected 67.24% (39/58) and 46.55% (27/58) of *Haemoproteus* sp., respectively. The prevalence of gastrointestinal parasites was 74.14% (43/58). Protozoa (100% for *Eimeria* sp.) were detected in 86.05% of the cases and nematodes (*Ascaridia* sp. and *Capillaria* sp.) in 32.56%, whereas 20.93% of the pigeons were infected by

multiple parasites. The fly *Pseudolynchia canariensis* was found beneath the feathers of all pigeons.

Msoffe *et al.*, (2010) conducted a study to assess the prevalence of parasites of domestic pigeons in Morogoro Municipality, Tanzania. 100 nestlings and 100 adult pigeons were examined for the presence of ecto and endoparasites. 159 pigeons (79.5%) were infected with one or more species of gastrointestinal helminthes, 62% had one or more ectoparasites and 37% was infected with haemoparasites. The 3 subfamilies represented two cestodes and one nematode, whereas no trematodes were found. Three species of helminthes *Raillietina tetragona* (6%), *Raillietina echinobothrida* (63%) and *Ascaridia galli* (15.5%) were identified. Three different species of ectoparasites such as *Pseudolynchia canariensis* (61.5%), *Menocanthus stramineus* (0.5%) and *Menopon gallinae* (0.5%), and 1 haemoparasite species *Haemoproteus columbae* were identified. Prevalence of gastrointestinal worms was significantly higher ($P < 0.001$) in adults than in nestlings. Nestlings appeared to be less susceptible to gastrointestinal cestodes but more susceptible to nematodes compared with adults. *P. canariensis* were found in both nestlings and adults pigeons while *M. stramineus* and *M. gallinae* were found in adult only. Prevalence of ectoparasites was not statistically significant ($P < 1$) between the two age groups. The prevalence of *H. columbae* was statistically higher ($P < 0.001$) in adults.

Mushi *et al.*, (2000) examined twelve adult domestic pigeons from Sebele, Gaborone, Botswana for the presence of helminth parasites and observed the cestode genus *Raillietina* and two species of nematodes, *Dispharynx spiralis* and *Ascaridia columbae*.

Mushi *et al.*, (2000) recorded the following parasites in apparently healthy pigeons kept in Sebele: a haemoprotozoan, *Haemoproteus columbae* (80 %); endoparasite metazoan nematodes, *Ascaridia columbae* (30 %) and *Dispharynx spiralis* (10 %); a cestode, *Raillietina* sp. (80 %) and coccidian oocysts (40 %); 2 ectoparasites, *Pseudolynchia canariensis* (50 %) and *Columbicola columbae* (30 %).

Natala *et al.*, (2009) collected samples from 250 domestic pigeon from a major slaughter slab in Zaria and recorded the prevalence of protozoa including *Eimeria* sp., *Haemoproteus columbae, Leucocytozoon* sp., *Plasmodium relictum* as 49.2%, 15.6%, 6.4%, 0.8% respectively and helminth including *Raillietina tetragona, Raillietina cesticillus, Raillietina echinobothridia, Ascaridia columbae, Ascaridia galli* and

Capillaria anatis as 4.9%, 3.0%, 7.6%, 1.2%, 1.2% and 0.8%, respectively while *Pseudolynchia canariensis* (17.6%) was the only ectoparasites.

Borghare *et al.*, (2009) examined 30 samples to investigate the helminthic infection in captive wild pigeons (*Columba livia*) at Maharajbagh Zoo, Nagpur and reported the incidence of *Capillaria* sp., *Ascaridia* sp. and Hetarakis sp. as 56.66%, 76.66%, 16.66% respectively, mixed parasitic infection in around 17 samples with either *Ascaridia* sp. and *Capillaria* sp. or with *Ascaridia* sp. and *Heterakis* sp. and cysts of *Balantidium coli* in one sample.

Nath *et al.*, (2014) examined a total of 100 pigeons and 100 chickens from four (4) selected districts of Bangladesh (Khagrachari, Bandarban, Sylhet and Sunamgonj) during the period of January to December' 2011 and reported that overall 2% pigeon and 12% chicken were found to be infected by *Leucocytozoon* sp.

Parsani *et al.*, (2014) reported that qualitative examination of 78 faecal samples of domestic wild and zoo pigeons in Gujarat, India revealed 71 (91%) with parasitic infections of nematodes (85%), cestodes (31%) and *Eimeria* sp. (77%). There were 200-1600 nematode eggs per gram during the monsoon season, which was high compared to the 200-1000 eggs per gram in winter and summer. In post-mortems 85% had parasitic infections, of nematodes (75%), cestodes (69%) and *Eimeria* sp. (58%). Two species of nematodes (*Ascaridia columbae* and *Capillaria obsignata*) and five species of threegenera of cestodes (*Raillietina echinobothridia, R. tetragona, R. cesticillus, Cotugnia digonophora* and *Hymenolepis* sp.) were identified.

Radfar *et al.*, (2012) collected five species of nematodes and cestodes from alimentary canals of pigeons including *Ascaridia colombae* (16.66%) and *Hadjelia truncata* (1.96%), *Cotugnia digonopora* (13.79%), *Raillietina* magninumida (18.62%) and *Raillietina achinobothridia* (32.35%) and fecal examination revealed: *Eimeria* spp. (40.19%) and Cryptosporidium oocysts (2.94%); and blood smears showed: *Haemoproteus cloumbae* (47.05%); in mouth, throat and larynx: Trichomonans *gallinae* (57.84%); four species of ectoparasites were collected from feathers and subcutaneous nodules as follows: feathers: *Pseudolynchia canariensis* (63.72%), *Columbicola columbae* (79.41%), *Menopen gallinea* (44.11%); subcutaneous nodules: *Laminosioptes cysticola* (1.96%).

Sari *et al.*, (2008) examined faecal samples from 251 pigeons (136 domestic pigeons and 115 wild ones) through the centrifugal flotation method using Sheather's saturated sugar solution and a modified acid-fast staining method. Coccidia oocysts were detected in 81 (59.6%) domestic pigeons and in 35 (30.4%) wild pigeons. Coccidian species identified in domestic pigeons were as follows: *Eimeria labbeana* (58.1%); *E. columbarum* (30.9%); *E. columbae* (22.1%) and *Isospora* sp. (18.4%). In wild pigeons, the oocysts of the following species were detected: *Eimeria labbeana* (28.7%), *E. columbarum* (10.4%), *E. columbae* (5.2%), and *Isospora* sp. (13.0%). Helminth eggs were found in faeces of 23.5% domestic pigeons and in 4.3% wild pigeons. The following helminth species were identified: *Capillaria* sp. (19.9%) *Ascaridia columbae* (5.1%), and *Heterakis* sp. (3.7%) in domestic pigeons; and *Capillaria* sp. (4.3%) and *Syngamus* sp. (1.7%) in wild pigeons.

Senlik *et al.*, (2005) demonstrated that 74% pigeons harboured helminth infections including Barus*Capillaria obsignata* (63%), *Ascaridia columbae* (42%) and *Raillietina echinobothrida* (1%). There were no significant differences in the prevalence of *B. obsignata* and *A. columbae* by host age and sex. Significantly the highest prevalence rate of *A. columbae* was observed in the autumn months, but there was no significant difference in the seasonal prevalence of *B. obsignata*. The mean intensity of *B. obsignata* and *A. columbae* was higher in adults than in young pigeons but it did not differ significantly between the two sexes. The highest mean intensity rate of *B. obsignata* was observed in the autumn, while there was no significant difference for *A. columbae* with regard to season.

Shinde *et al.*, (2008) examined the pigeons (1000 carcasses) in urban localities of Mumbai city for prevalence of parasitic fauna revealed nematode species like *Capillaria obsignata* and *Ascaridia columbae*, cestode species like *Raillietina tetragona*, R. *echinobothrida*, *R. cesticillus* and *Cotugnia digonopora*, coccidian species were *Eimeria columbae* and *E. labbeana* and the ectoparasites were *Pseudolynchia canariensis*, *Goniocotes bidentatus* and *Columbicola columbae*. Majority of pigeons showed mixed infections of ecto and endoparasites. *Haemoproteus columbae* was recorded in 35 out of 60 live pigeons on blood smear examination.

Sivajothi and Reddy (2015) examined faecal samples of 132 pigeons from four different farms of Y S R Kadapa district of Andhra Pradesh in India for the presence of

gastrointestinal parasites by direct smear examination, flotation and sedimentation techniques and observed overall 72.7 % of the birds harbored parasites including *Ascaridia colombae* (33.3%), *Eimeria* spp. (31.0%), *Capillaria colombae* (17.4%) and *Raillietina* (9.0%), mixed infections (36.6%) and high prevalence in adults (75%) than squabs (64.2%).

Stenzel and Koncicki (2007) conducted a study to evaluate the occurrence of parasitic invasions in domestic pigeons in the Northern Poland. In years 2005/2006, 55 lofts of carrier pigeons and 11 lofts of fancy pigeons were examined. One hundred and three individual dropping samples collected during pigeon exhibitions were also investigated. The study revealed that 56.4% of carrier pigeons lofts and 90.9% of fancy pigeon's lofts were infected by coccidia. *Ascaridia columbae* was found in 5.5% lofts of carrier and 15.5% of fancy pigeons on the exhibitions. Eggs of *Capillaria* (C.) *obsignata* were found in 3.6% carrier pigeons and in 36.4% fancy pigeon's lofts. *Trichomonas columbae* were observed in 61.8% of carrier pigeons and in 100% of fancy pigeon's lofts.

Tanveer *et al.*, (2011) examined faecal samples of 143 (80 male and 63 female) domestic pigeons to determine the gastrointestinal nematodes of domestic pigeons through qualitative and quantitative faecal examinations. The overall prevalence of gastrointestinal nematodes was 40.5% in domestic pigeons and in males and females was 41.3% and 39.7% respectively. The overall prevalence of *Capillaria obsignata* and *Ascaridia columbae* was found to be 67.2% and 32.8% and in males was 72.7% and 27.8% and in females was 60% and 40% respectively. There was no significant sex related difference seen in the prevalence of C. *obsignata* (P>0.56) and *A. columbae* (p>0.40) in domestic pigeons, respectively.

2.2 Pathological changes produced by parasites in pigeon

Abed *et al.*, (2014) studied histopathological changes including ulceration and sloughing of epithelial lining of intestine mucosa, distraction and degeneration of villi, desquamation of epithelium, destruction of secretary glands, infiltration of inflammatory cells and atrophy of villi. Liver of pigeon show severe necrosis and infiltration of inflammatory cells also there is vaculation of hepatocytes, congestion, hyperplasia of hepatocytes and some hepatocytes undergone fatty changes.

Bahrami *et al.*, (2013) reported mild congestion in the tissue of small and large intestine of old pigeon infected with parasites. Histopathological changes including degenerative changes in the epithelial tissues of the intestine were observed in pigeons below 2 years old in comparison with above 2 years old birds.

Bahrami *et al.*, (2013) studied histo-pathological effects of different arthropod, *oocyst* and worms infestation on the naturally infected wild pigeon and reported that degenerative changes in the epithelial tissues of the esophageal and proventriculus gland as well as destructive changes in the epithelium of the esophagus, duodenum and cecum of the pigeons infected with different worms and protozoa. Massive congestion was seen in tissue of pancreas & trachea.

Begum *et al.*, (2008) reported that pathological lesions of *Trichomonas gallinae* were confined in the crop, proventriculus and liver. There was an accumulation of greenish fluid and/or cheesy material in the crop and proventriculus. At necropsy, yellowish to grayish necrotic lesions were evident in the crop and proventriculus. On the other hand, the liver became congested where congestion of sinusoids and focal accumulation of heterophils in the parenchyma were found. But, no microscopic lesions were seen in the crop and proventriculus although gross lesions were more prominent in these two organs.

Dey *et al.*, (2010) observed pathological lesions in case of *Leucocytozoon* sp. and *Haemoproteus* sp. The suspected organs such as liver, lungs, kidney and heart were apparently normal. Microscopically, there were degeneration and dissolution of vascular endothelial cells in the heart was seen in case of *Leucocytozoon* infection. Comma shaped organism were detected in both cases and also infiltration of inflammatory cell. Schizonts were observed in liver parenchyma.

El-Khatam and Laila (2016) studied the histopathological changes of *T. gallinae* in crop, liver, larynx, and trachea as poorly eosinophilic bodies with severe inflammatory cell infiltration

Nisar *et al.*, (2015) conducted a study to observe histopathological changes in intestines of *Columba livia* artificially infected with *C. digonopora* and *C. cuneata* observed infiltration of inflammatory cells in lamina propia, some portion of worm in muscular layer and necrotic serosa in *C. digonopora* infested pigeon and migratory tunnels formed along with fibrosis, necrosis and villous atrophy in *C. cuneata* infested pigeon.

Shaikh *et al.*, (2016) observed histopathological findings of helminth infected pigeon including architechtural designtegration of muscularis layer, destruction of crypt and Brurnner's glands, serosal necrosis, migratory tunnels formed along with fibrosis, villus atrophy and necrosis and infiltration of mononuclear (lymphocytes and macrophages) inflammatory cells in lamnia propria in the duodenum of intestine.

CHAPTER 3

MATERIALS AND METHODS

3.1 Instrument and appliances used during this study

- Scissors
- Forceps
- Gloves
- Musk
- Scalpel
- Knife
- Cotton
- Petridishes
- Beaker
- Stirrer
- Sieve
- Plastic bottle
- Vial
- Clean slides
- Cover slips
- Microscope

3.2 Chemicals and reagents used during this study

- 10% formalin
- Paraffin
- Alcohol
- Tap water
- Mounting media (DPX)
- Hematoxylin and Eosin stain
- Distilled water
- Lactophenol
- Saturated salt solution (NaCl)
- Acetic acid

Materials and method can be described by following way

3.3 Selection of study area and experimental birds

In Bangladesh, the Joypurhat district is locally known as poultry zone. The study was carried out in this area from July to December 2018. A total of 140 birds ,where 94 adults and 46 young and also 82 female and 73 male were taking into account from various farms of sadar upazila under Joypurhat (25.10 N 89.03 E) district in Bangladesh.

With the help of owner, data was collect from each 82 bird by developing some questions pattern conforming the age of birds by the help of owner or different methods such as iris colour or cloacal sex character or knotty or glandular bursa, male and female was identified by physical apparent or gait described by Hazzard (1922). Majority of the birds divided into two groups:

a) Young : 2.5 to 3 month
b) Full –aged: greater than 3 month.

3.4 Sample collection and examination

Test of each pigeon for external parasite and faecal sample and also blood sample is taken into the HSTU parasitology lab. Fecal sample were taken into a small vial with 10% formalin before sample is taking the vial must be clean and dried and marking the vial with the help of microscope different types qualitative test such as direct smear or floatation or sedimentation are used. If direct smear method is failed to identify the eggs of parasite then other test can be done (Soulsby, 1982) to identify the egg of various parasite. In the direct smear technique very little amount of faeces are used and mixing a drop of water, stirring by platinum loop and then apply cover slip and examined at low (10X) and high (40X) power objects. Direct smear method is help to identify the eggs of helminthand *Oocyst* of *Eimeria*.

3.4.1 Direct Smear

Placing a small amount of feces on a microscopic slide. Adding a drop of liquid (water) to the feces and mix thoroughly. Covered with a cover slip. Examined the slide using the 10X objective, and then go over it with the 40X objective.

Figure 1: Collection of faeces

3.4.2 Sedimentation technique

For trematode egg-

3 g feces and 30-40 ml tap water was mixing throughly with a stirring device and filtering the fecal suspension or cheese cloth, allowing the sediment for 5 minutes then discarding the super natant portion and transfering the sediment into micro slide and covering it by cover slip .

3.4.3 Floatation technique

For nematodal eggs-

3 g of feces mixing with floatation fluid (saturated salt solution) and were poured into testube then applying the cover slip in top meniscus and then it stay 10-15 min, finally the cover slip turned and placed into glass slide and observed under microscope.

3.4.4 Tracheal swab examination

For *Trichomonas gallinae*

Swab from crop is taken and examined the protozoa (motile, moving) confirming the different characters and also helped by the Dougalad technique.

Figure 2: Collection of Tracheal swab

3.5 External parasites collection and identification

Any ectoparasites were collected from the skin and/or plumage. Lice were obtained from different host specimens were separately kept to avoid any confusion. In many cases, it was possible to identify these species depending on their distinctive characteristics, and hence also determine their prevalence and intensities, by directly examining them under low-power objectives they were preserved in 70% isopropyl alcohol (lice and mites) or 70% ethanol (other species) to be prepared and identified to facilitate this process, the ectoparasites were subjected to an overnight clearance in 10% potassium hydroxide, washed, stained in aniline oil, washed to remove excess stain, dehydrated in alcohol, cleared in xylene and permanently mounted in Canada balsam.

Figure 3: Collection of ectoparasites

3.6 Postmortem examination

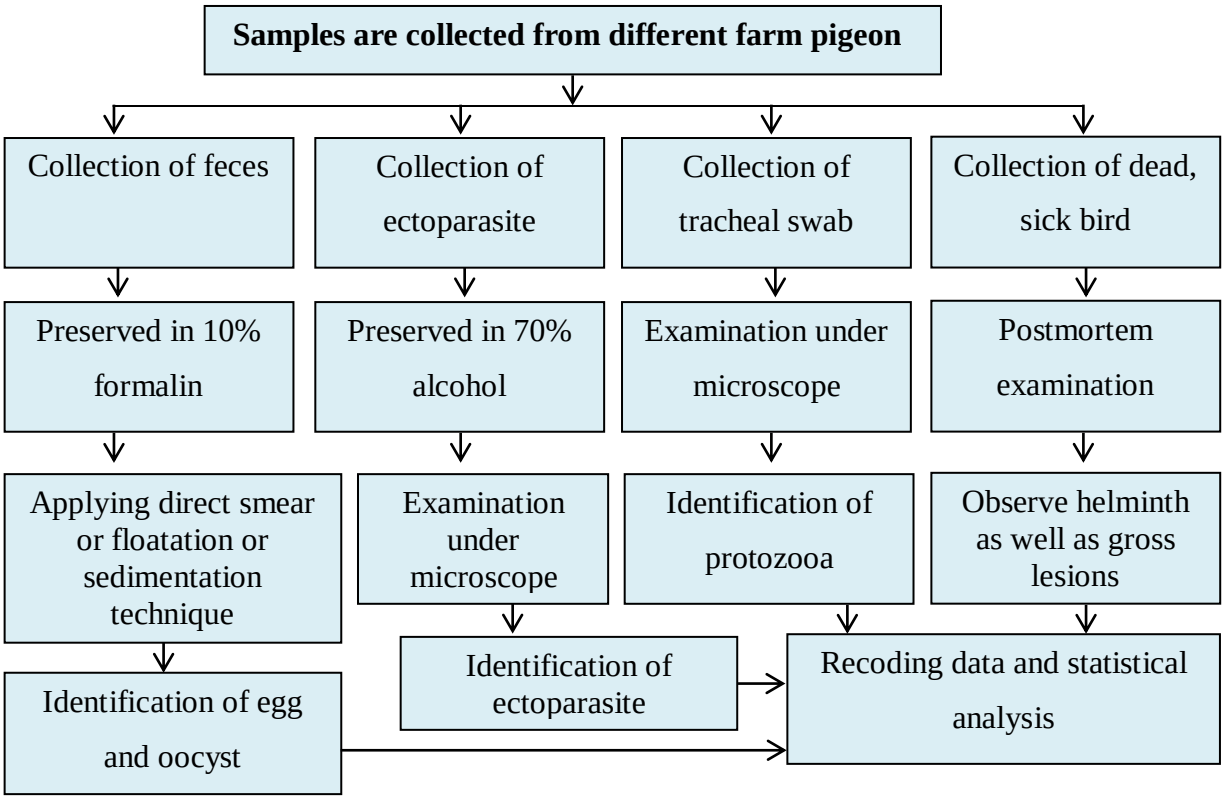
Postmortem examination can be done in apparently healthy or sick or dead pigeon. Intestine can be preserved by chemical solution (formalin solution or buffered formalin solution. Various cross cutting and stained by H & E as per standard value.

Figure 4: Postmortem examination and collection of sample

3.7 Statistical comparison

The raw data are arranged in ANOVA (one way) or IBM SPSS (20 version) for Chi square test and published in percentage with P- value, where it is significant or not (less than 0.05).predominance or exorbitance was work out and detached by F – variance test. Expressing odds ratio by Schessman formula or others.

3.8 Experimental layout



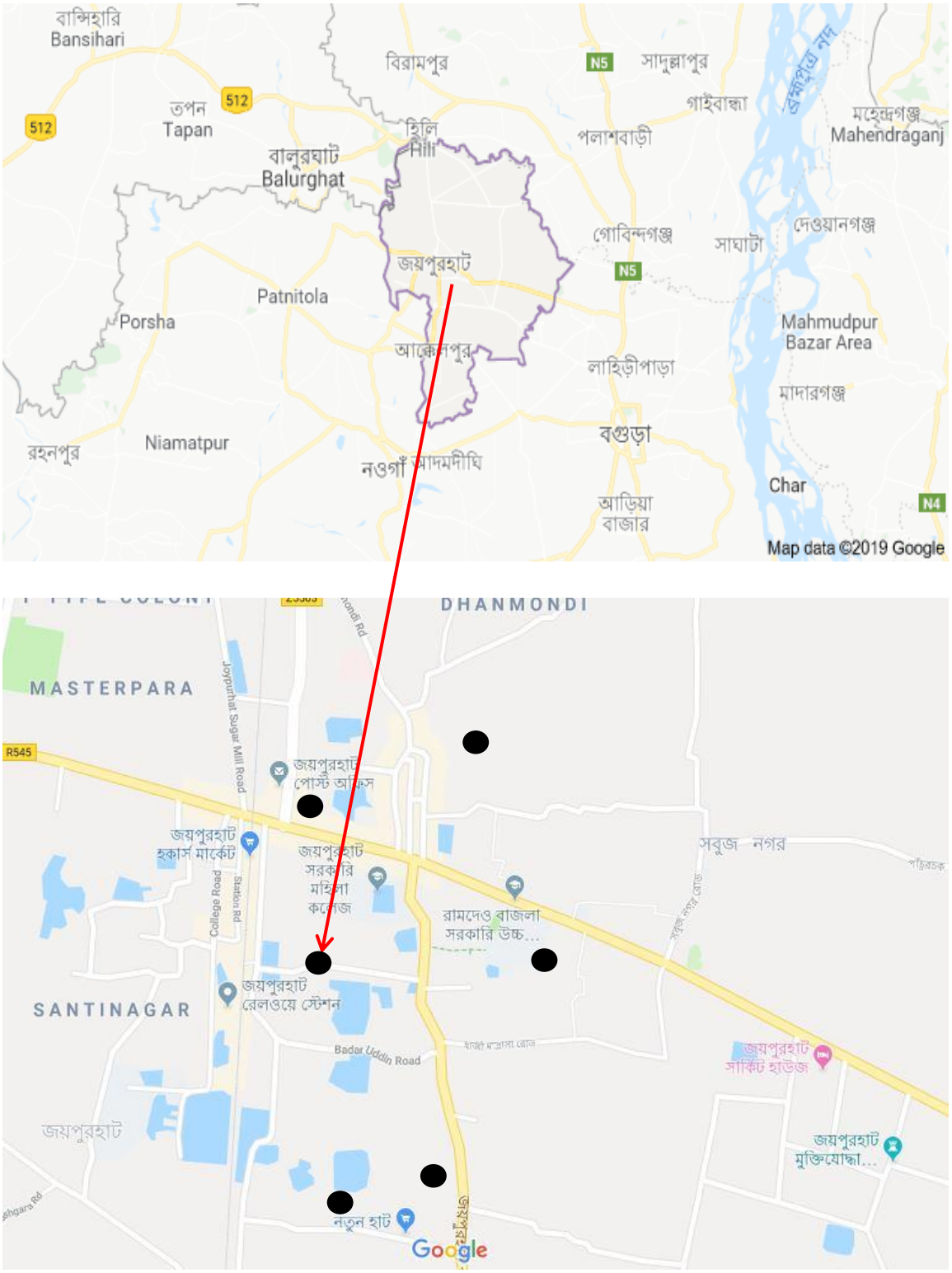


Figure 5: Maps show the study area (Joypurhat Sadar, Joypurhat, Bangladesh). Black points indicate the sites of sample collection.

CHAPTER 4

RESULTS

Table 1: Prevalence of parasites in farmed pigeon at Joypurhat sadar (N=140)

Name of parasites	No. of infected pigeon	Prevalence (%)
Helminth		
Overall	107	76.42
Heterakis sp.	40	28.57
Capillaria sp.	32	22.85
Ascaridia sp.	36	25.71
Raillietina sp.	28	20
Echinostoma sp.	38	27.14
Protozoa		
Overall	47	33.57
Trichomonas sp.	34	24.28
Eimeria sp.	40	28.57
Ectoparasites		
Overall	127	90.71
Menacanthus sp	48	34.28
Lipeurus sp.	50	35.71
Menopon sp.	36	25.71
Columbicola columbae	60	42.85

N= Number of bird examined

4.1 Overall prevalence of parasites in farmed pigeon

In above table a number of 140 birds were examined, where 107 (76.42%), 47(33.57%) and 127 (90.71%) were infected with various species of ectoparasie, protozoa and helminth. The current study show that the highest prevalence rate of helminth was *Heterakis* sp. (28.57%) proceeded by *E. chinostoma* sp (27.14%), *Ascaridia* sp. (25.71%), *Capillaria* sp. (22.85%) and *R. aillietina* sp. (20%). Among protozoan parasite two species were identified where *Eimeria* sp (28.57%) and *Trichomonas* sp. (24.28%). In that study, during lab examination 4 species of ectoparasite were found where *Menacanthus* sp., *Lipeurus* sp., *Menopon* sp. and *Columbicola columbae* and their percentage is given accordingly 34.28%, 35.71%, 25.71% and 42.85% is highest prevalence in *Columbicola columbae* ectoparasite.

Table 2: Age related prevalence of parasites in farmed pigeon at Joypurhat sadar

Name of parasites	Age		P value	Odd ratio
	Young (N=46) Positive no (Prevalence)	**Adult (N=94) Positive no. (Prevalence)**		
Helminthes				
Overall	**22 (47.82%)**	**77 (81.91%)**	**0.31 (NS)**	**Adult vs Young =4.94**
Heterakis sp.	04 (8.69%)	22 (23.40%)	0.52 **(NS)**	
Capillaria sp.	04 (8.69%)	28 (29.78%)	0.42 **(NS)**	
Ascaridia sp.	10 (21.73%)	30 (31.91%)	0.28 **(NS)**	
Raillietina sp.	02 (4.34%)	26 (27.65%)	0.38 **(NS)**	
Echinostoma sp.	08 (17.39%)	28 (29.78%)	0.001 **(S*)**	
Protozoa				
Overall	**18 (39.13%)**	**28 (29.78%)**	0.28 (NS)	**Young vs Adult = 0.66**
Trichomonas sp.	16 (34.78%)	18 (19.14%)	0.001 (S*)	
Eimeria sp.	14 (30.43%)	30 (31.91%)	0.15 (NS)	
Ectoparasites				
Overall	31 (67.39%)	69 (73.40%)	0.05 (S)	**Adult vs Young =1.33**
Menacanthus sp.	12 (26.08%)	34 (36.17%)	0.15 (NS)	
Lipeurus sp.	18 (39.13%)	32 (34.04%)	0.001 (S*)	
Menopon sp.	10 (21.73%)	32 (34.04%)	0.02 (NS)	
Columbicola columbae	22 (47.82%)	40 (42.55%)	0.001 (S*)	

N= Number of bird examined

(S*) means highly significant at P<.001

(S) means significant at 5% level.

NS means non significant.

4.2 Age related prevalence of parasites in farmed pigeon

The total prevalence of helmintic parasites was highest in adult (81.91%) than young (47.82%) pigeon but the difference was not highly significant. The odd ratio Adult vs Young signify that adults are 4.94 times highly susceptible to helminthes than young. The prevalence of *Heterakis* sp., *Capillaria* sp., *Ascaridia* sp., *Raillietina* sp. and *Echinostoma* sp. in young and adult was 8.69%, 23.40%;8.69%, 29.78%, 21.73%, 31.91%, 4.34%, 27.65%,17.39% and 29.78%, respectively (Table 2). The prevalence rate of *Echinostoma* sp. was significantly ($P<0.001$) higher in adult than young pigeons but the others were not significant ($P>0.05$).

The highest prevalence of protozoan parasites was found in young (39.13%) than adult (29.78%) pigeon but there was not highly significant difference between age groups. The odd ratio of Young vs Adult 0.66 means that young are 0.66 times more susceptible to a than adults. The prevalence of *Trichomonas* sp. was highly significant ($P<0.01$) higher in young (34.78%) than adult (19.14%) pigeon. In case of *Eimeria* sp., the prevalence was higher in adult (31.91%) in compare to young (30.43%) pigeons.

The current study showed that the overall prevalence of ectoparasites was significantly ($P<0.001$) highest in adult (73.40%) than young (67.39%) pigeons. The odd ratio of adult vs young signifying that 1.33 means adults are 1.33 times highly susceptible to ectoparasites than young. The prevalence rate of *Menacanthus* sp, *Lipeurus* sp, *Menopon* sp and *Columbicola columbae* are accordingly young and adult are given serially 26.08%, 36.17%, 39.13%, 34.04%, 21.73, 34.04%, 47.82 and 42.55%. In case of *Columbicola columbae,* where higher in young at $P<0.001$ highly significant rather than adult.

Table 3: Sex related prevalence of parasites in farmed pigeon at Joypurhat sadar

Name of parasites	Sex		P value	Odd ratio
	Male (N=58) No. positive (Prevalence)	Female (N=82) No. positive (Prevalence)		
Helminthes				
Overall	37 (63.79%)	67 (81.70%)	0.54 (NS)	**Female vs Male=2.53**
Heterakis sp.	10 (17.24%)	28 (34.14%)	0.39 (NS)	
Capillaria sp.	12 (20.68%)	20 (24.39%)	0.001 (S*)	
Ascaridia sp.	18 (31.03%)	22 (26.82%)	0.17 (NS)	
Raillietina sp.	08 (13.79%)	20 (24.39%)	0.005 (S)	
Echinostoma sp.	18 (31.03%)	24 (29.26%)	0.001 (S*)	
Protozoa				
Overall	17 (29.31%)	23 (28.04%)	0.28 (NS)	**Male vs Female=1.06**
Trichomonas sp.	12 (20.68%)	20 (24.39%)	0.001 (S*)	
Eimeria sp.	24 (41.37%)	20 (24.39%)	0.22 (NS)	
Ectoparasites				
Overall	41 (70.68%)	68 (82.29%)	0.005 (S)	**Female vs Male=2.01**
Menacanthus sp.	14 (24.13%)	34 (41.46%)	0.001 (S*)	
Lipeurus sp.	22 (37.93%)	28 (34.14%)	0.18 (NS)	
Menopon sp.	10 (17.24%)	26 (31.70%)	0.002 (S)	
Columbicola columbae	24 (41.37%)	38 (46.34%)	0.001 (S*)	

N= Number of bird examined

(S*) means highly significant at P<.001

(S) means significant at 5% level .

NS means non significant

4.3 Sex related prevalence of parasites in farmed pigeon

The present study indicated that female pigeons (81.70%) were more susceptible to helminth parasites than male pigeons (63.79%) where it was not statistically significant (P>0.05). The odd ratio of female and male 2.53 signifies that females were 2.53 times highly susceptible than male pigeon. The prevalence percentage of *Heterakis* sp., *Capillaria* sp., *Ascaridia* sp., *Raillietina* sp. and *Echinostoma* sp. in male and female accordingly; 17.24%, 34.14%, 20.68%, 24.39%, 31.03%, 26.82%, 13.79%, 24.39%, 31.03% and 29.26% (Table 3). The prevalence of *Echinostoma* sp. and *Ascaridia* sp. in male were statistically higher than female but only *Echinostoma* sp. is highly significant and also *Raillietina* sp. is significant at <0.005.

Epoch this study, it was found that males (29.31%) were higher in prevalence of protozoa than females (28.04%). The odd ratio 1.06 means that males were 1.06 times more susceptible than female pigeon. The prevalence of *Trichomonas* sp. *Eimeria* sp. in male was 20.68%, 41.37% respectively and in female was 24.39% and 24.39% respectively (Table 3). In case of *Trichomonas* sp. there is a highly significant at P< 0.001.

The current observation showed that the prevalence of ectoparasites was significantly P<0.001 and (P<0.05) higher in female (82.29%) than male (70.68%). The odd ratio 2.01 means that females were 2.01 times more susceptible than male. The prevalence of *Menacanthus* sp., *Lipeurus* sp., *Menopon* sp. and *Columbicola columbae* in male was 21.13%, 37.93%, 17.24% and 41.37% respectively and in female was 41.46%, 34.14%, 31.70% and 46.34% respectively (Table 3). There was significant (P>0.001) sex related difference seen in the prevalence of *Menacnthus* sp. and *Columbicola columbae* in case of *Lipeurus* sp. males are significantly higher in compare to female pigeons.

Table 4: Intensity of parasitic infections in farmed pigeons at Joypurhat sadar (N=140)

N= Number of bird examined Name of parasites	No. of birds infected	Intensity		P value
		Range	(Mean±SE)	
Helminthes				
Heterakis sp.	40	1-4	2.5±0.50	<0.05
Capillaria sp.	32	1-5	3.49±0.41	
Ascaridia sp.	36	2-5	2.50±0.27	
Raillietina sp.	28	1-6	3.50±0.33	
Echinostoma sp.	38	1-5	2.75±0.40	
Protozoa				
Trichomonas sp.	34	1-5	3.33±0.34	<0.05
Eimeria sp.	40	2-10	4.49±0.44	
Ectoparasites				
Menacanthus sp.	48	4-32	18.78±0.71	<0.05
Lipeurus sp.	50	5-34	23.33±0.49	
Menopon sp.	36	5-48	33.18±0.71	
Columbicola columbae	60	10-50	28.32±0.69	

SE means Standard Error.

4.4 Overall intensity of parasitic infections in pigeon

The outcome of presented in (Table 4) shown that the intensity of different parasitic infections in farmed pigeons. The mean intensity of helminth parasites was higher in *Raillietina* sp. (3.50±0.33) followed by *Capillaria* sp. (3.49±0.23), *Echinostoma* sp. (2.75±0.40) *Ascaridia* sp. (2.50±0.27) and *Heterakis* sp. (2.5±0.50), respectively.

The mean of different protozoa was for *Trichomonas* sp., *Eimeria* sp. 3.33±0.34, 4.49±0.44, respectively and different ectoparasites comprising *Menacanthus* sp., *Lipeurus* sp., *Menopon* sp., *Columbicola columbae* was18.78±0.71; 23.33±0.49; 33.18±0.71 and28.32±0.69 respectively. The highest intensity was found in *Eimeria* sp. of protozoa and *Menopon* sp. of ectoparasites, respectively

Table 5: Intensity of parasitic infections in farmed pigeons according to age at Joypurhat sadar

Name of parasites	Age				P value
	Young (N=46) Intensity		Adult (N=94) Intensity		
	Range	(Mean±SE)	Range	(Mean±SE)	
Helminthes					
Capillaria sp.	1-4	3.5±0.50	2-5	3.21±0.31	0.67 (NS)
Ascaridia sp.	1-4	2.80±0.32	2-4	2.73±0.23	0.87 (NS)
Raillietina sp.	2-3	4.00±0.51	3-6	3.53±0.49	1.00 (NS)
Echinostoma sp.	1-3	3.4±0.50	2-5	3.13±0.30	0.48 (NS)
Protozoa					
Trichomonas sp.	2-4	3.62±0.37	2-5	3.22±0.46	0.50 (NS)
Eimeria sp.	2-7	6.33±0.72	3-6	3.6±0.30	0.001 (S*)
Ectoparasites					
Menacanthus sp	4-20	21.16±0.94	12-20	21.82±0.8	0.60 (NS)
Lipeurus sp.	6-18	25.62±0.99	20-37	25.93±0.99	0.41 (NS)
Menopon sp.	8-17	40.80±4.78	15-35	33.15±2.91	0.18 (NS)
Columbicola columbae	10-26	41.90±1.80	10-45	41.38±1.67	0.49 (NS)

SE means Standard Error

4.5 Intensity of parasitic infections in pigeon according to age

During this observation, the mean intensity of *Heterakis* sp., *Capillaria* sp., *Ascaridia* sp., *Raillietina* sp. and *Echinostoma* sp., *Trichomonas* sp., *Eimeria* sp., *Menacanthus* sp., *Lipeurus* sp., *Menopon* sp. and *Columbicola columbae* in young and adult are 3.5±0.50, 3.21±0.31, 2.80±0.32, 2.73±0.23, 4.00±0.51, 3.53±0.49, 3.4±0.50, 3.13±0.30, 3.62±0.37, 3.22±0.46 and 6.33±0.72; 3.6±0.30, 21.16±0.94, 21.82±0.8, 25.62±0.99, 25.93±0.99, 40.80±4.78, 33.15±2.91, 41.90±1.80 and 41.38±1.67. The current study showed that statistical comparison of mean intensity of different parasites per infected birds between young and adult was not significantly ($P>0.05$) but the mean intensity of infected pigeons in adult was statistically higher ($P<0.001$) than young for *Eimeria* sp. The mean intensity of *Trichomonas* sp. was higher in young than adult pigeons but others were higher in adult than young pigeons.

Table 6: Intensity of parasitic infections in farmed pigeons according to sex at Joypurhat sadar

Name of parasites	Sex				P value
	Male (N=58) Intensity		Female (N=82) Intensity		
	Range	(Mean±SE)	Range	(Mean±SE	
Helminthes					
Heterakis sp	2-4	2.5±0.50	3-4	2.38±0.31	0.38(NS)
Capillaria sp.	2-5	3.5±0.42	2-5	3.10±0.37	0.001(S*)
Ascaridia sp.	1-3	2.73±0.27	2-7	2.76±0.26	0.49(NS)
Raillietina sp.	1-3	5.5±0.64	2-5	3.4±0.47	0.43(NS)
Echinostoma sp.	2-4	2.85±0.26	3-5	3.38±0.36	0.51(NS)
Protozoa					
Trichomonas sp	2-3	3.57±0.36	2-4	3.30±0.44	0.30(NS)
Eimeria sp.	3-6	4.66±0.67	4-7	4.58±0.51	0.01(S*)
Ectoparasites					
Menacantus sp.	16-20	19.83±1.30	15-25	22.29±0.70	0.66(NS)
Lipeurus sp.	17-25	25.90±1.10	18-30	27.01±1.01	0.57(NS)
Menopon sp.	18-33	40.60±3.90	22-33	33.23±3.0	0.68(NS)
Columbicola columbae	17-25	41.81±1.57	20-40	41.41±1.63	0.58(NS

SE means Standard Error

4.6 Intensity of parasitic infections in pigeon according to sex

It was noted that there was no significant (P>0.05) difference between male and female pigeons for the mean intensity of different parasites through infected pigeons. The mean intensity of *Heterakis* sp., *Capillaria* sp., *Raillietina* sp., *Trichomonas* sp., *Eimeria* sp., *Menopon* sp., *Columbicola columbae*, in male was 2.5±0.50, 3.5±0.42, 5.5±0.64, 3.57±0.364, 66±0.67, 40.60±3.90, 41.81±1.57, respectively which was minimal higher than female pigeons in where the mean intensity was 2.38±0.31, 3.10±0.37, 3.4±0.47, 3.30±0.44, 4.58±0.51, 41.41±1.63, respectively but in others were slightly higher in male.

Figure 6: Lice in Pigeon

Figure 7: Distended intestine

Figure 8: Blockage of intestinal lumen by parasites

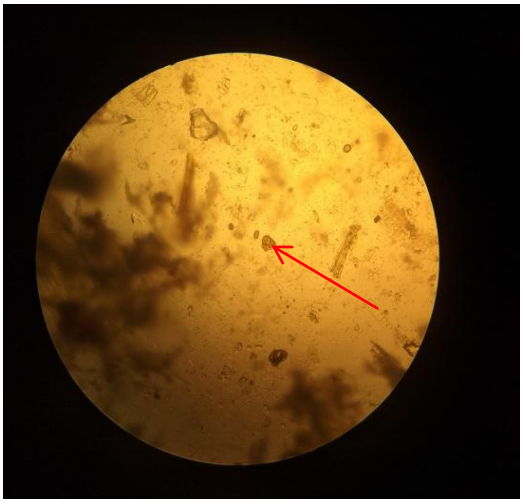


Figure 9: Egg of *Capillaria* sp.

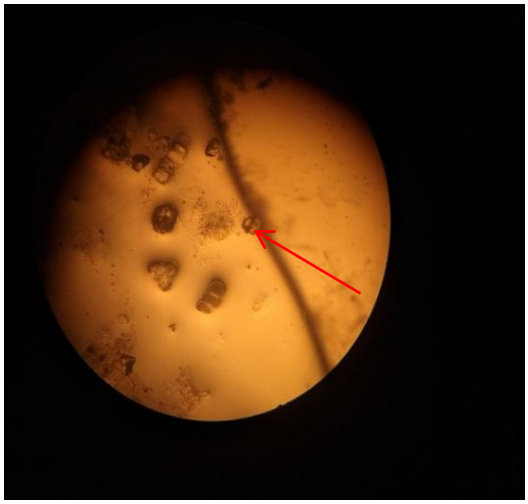


Figure 10: Egg of *Echinostoma sp.*

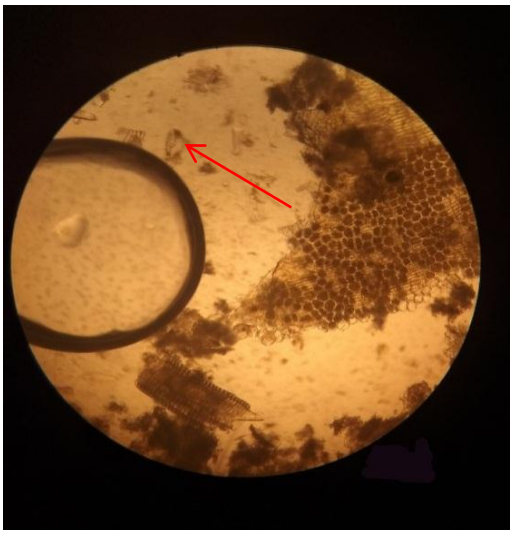


Figure 11: *Oocyst* of *Eimeria sp.*

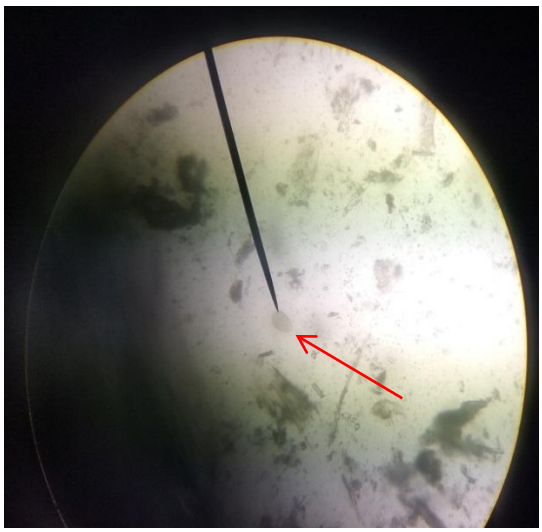


Figure 12 : Egg of *Heterakis sp.*

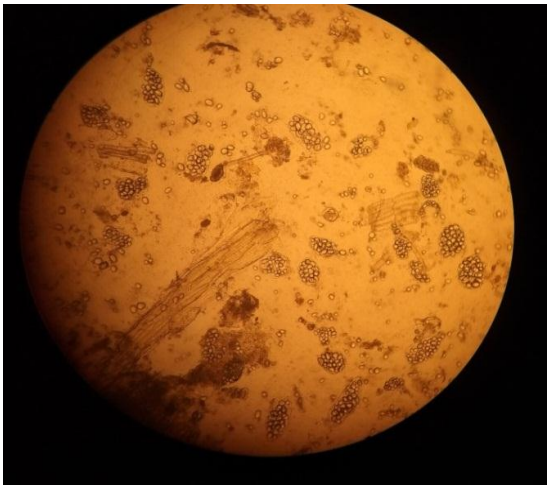


Figure 13: Egg of *Raillietina sp.*

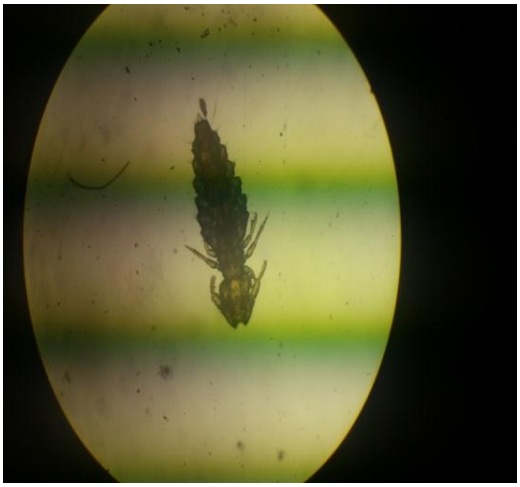


Figure 14: *Menopon* sp.

Figure 15: *Columbicola columbae*

Figure 16: *Menacanthus sp.*

CHAPTER 5

DISCUSSION

5.1 Prevalence of parasite in pigeons complete in all parts

The current investigation demonstrated that 76.42% of all examined pigeons were infected with helminthes (*Heterakis* sp. 28.57%, *Ascaridia* sp. 25.71%, *Capilaria* sp. 22.85%, *Raillitiena* sp. 20% and *Echonostoma* sp. 27.14%). The prevalence of helminthic infections recorded in this study is considered meekly. Previous surveys on helminth parasites in pigeons in the world are partially comparable with the results in the current study. In our study highest and lowest infections were with *Heterakis* sp. and *Raillitiena* sp., respectively, which resemble to the study carried out by Ashrafihelan *et al.,* (2010) on pigeons. Borghare *et al.,* (2009) displayed heavy infection with *Capillaria* spp., *Ascaridia* spp. and *Hetaraki*s sp. while in my study it is resemble to other results (Borghare *et al.,* 2009). In present study, (*Heterakis* sp. 28.57% and *Echonostoma* sp. 27.14%) infection respectively which is higher than Adang *et al.,* (2008) but lower than Borghare *et al.,* (2009) and Ibrahim *et al.,* (1995).

Ecihnostoma and *Ascaridia* are one of the common pathogens of pigeons which has been reported by a few workers from different parts of the world (Bernard and Biesman, 1987, Begum & Shaikh, 1987, Kulisic, 1989, Martinez *et al.,* 1989, Tacconi *et al.,* 1993, Ibrahim *et al.,* 1995, Hayat *et al.,* 1999, Mushi *et al.,* 2000, Senlik *et al.,* 2005, Msoffe *et al.,* 2010). The current study revealed that the overall prevalence of 76.42%) which was higher than that reported by Nagwa *et al.,* (2013) in Egypt, 14.3% and lower than that recorded by Tanveer *et al.,* (2011) in Pakistan, 40.5%. The prevalence of *Heterakis* sp. (28.57% *Ascaridia galli* (25.71%) in our investigation was higher than those determined by Radfar *et al.,* (2012a) in Iran, Nagwa *et al.,* (2013) in Egypt, Natala *et al.,* (2009) in Nigeria and Djelmoudi *et al.,* (2014) in Algeria, 16.66%, 12%, 1.2 % and 4.2% respectively but was lower than those reported by Permin *et al.,* (2002) in Zimbabwe, Sam-Wobo and Mafiana (2003) in Nigeria and Abed *et al.,* (2014) in Al-Dewaniya city, Iraq which had 69, 73.4% and 38.94% respectively. *A. columbae* is one of the common nematodes of pigeons which have been reported in different parts of the world (Mushi *et al.,* 2000; Senlik *et al.,* 2005; Msoffe *et al.,* 2010). The prevalence of *Capillaria* spp. (4%) was like that recorded by Baris *et al.,* (2008) in Turkey, (4.3%). It was higher than

that recorded by Khezerpour and Naem (2013) in domestic pigeons in Iran (0.72%) but lower than those recorded by Ghosh *et al.,* (2014) in Bangladesh and Eljadar *et al.,* (2012) in Green Mountain Region, Libya, 22 and 20% respectively. The prevalence of *Rallitiena* spp. was 20% which was found to be lower than done by Ashenafi and Eshutu (2004) in Central Ethiopia 32.6 in chickens but higher than those reported by Eljadar *et al.,* (2012) in domestic pigeon in Green Mountain Region, Libya 10%; Borji *et al.,* (2012) in Mashhad Iran 1.85% and Baris *et al.,* (2008) i.

The current study shows that prevalence of protozoan parasite 33.57% where *Trichomonas* sp. is lower than other species. Higher prevalence in *Eimeria* sp. is noticeable (28.57%) that observation is similar to the Eljarder *et al.,* (2014).

Begum *et al.,* (2008) who observed epidemiology and pathology of protozoan parasites in *Trichomonas gallinae* in the common pigeon (*Columba livia*). The present study thus provides baseline or preliminary information on the subject.

The results presented in Table 3 show that the overall prevalence of infestation was 100% in both sexes and the intensity of females was higher (20.09) than the males (19.28). The male and female birds had eleven endoparasite species each. *Raillietina echinobothrida*, *R. cesticillus* and *Cotugnia cuneata* showed 100% prevalence both in male and female birds. Highest intensity of infection (5.77) was found in *C. celebesensis* male and 4.46 was in *Hymenolepis columbae* female pigeon. Differences between the overall intensity of male and female hosts were very poor, so with this study, it has been proved that gender is not important in helminth infections in pigeon. It was found that the infection rates of male and female were very close to each other, which was statistically insignificant (P>0.05) Begum *et al.,* (2011).

The prevalence of ectoparasites and helminths among species of wild birds has been studied to a great extent. The present study shows that the overall 90.71% pigeons were infested by the 4 species of ectoparasites including *Columbicola columbae* (42.85%), *Menopon* sp. (25.71%) and *Lipeurus* sp. (35.71%) and *Menacanthus* sp. The present findings are slightly higher than the findings of Adang *et al.,* (2009 and). Begum *et al.,* (2011) who reported 83.8% pigeons were infested with ectoparasites. These results much higher to related with the results of Radfar *et al.,* (2011) who reported *Columbicola columbae* (79.41%) and *Menopon* sp. (44.08%). The prevalence of *Columbicola columbae* and *Menopon* sp. was lower than the findings of Begum *et al.,*

(2011) who reported that the prevalence of *Columbicola columbae* and *Menopon* sp. was 100% and 100% respectively but the higher prevalence of *Lipeurus* sp. was found in the present investigation than the reports of Begum *et al.,* (2011). . The overall prevalence of various parasites differs greatly among the previous reports as well as when compared with present observation. Diversity of bird endoparasite assemblages may be related many factors, which may include home range, behaviour, size and roosting habit of the host. This may also be attributed to difference in the geographical areas and period of study.

5.2 Age related prevalence of parasites in pigeons

Age related prevalence shows that impact of age on the prevalence of helminth, protozoan and ectoparasite in my study. The total prevalence of helminthic parasites was highest in adult (3 month) (81.91%) than young (<2.5 month) (47.82%) pigeon and that result is similar to Reddy (2015). Age of the host had an effect on the prevalence of *Trichomonas gallinae* in pigeons. Prevalence of *T. gallinae* was higher (34.7%) in young aged between 30 to 70 days than in *Eimeria* sp. (30.43%) and in adult pigeons aged >90 days (31.91%), which supported the findings of Hinshaw (1965) and Nasrin (2004). Hinshaw (1965) reported the major inroads of the *T. gallinae* occurred at 16-30 weeks of age in turkey. Nasrin (2004) reported the overall helminths incidence was higher in adult pigeons than in squabs. But, Soulsby (1982) reported 80-90% or more of the adult pigeons were infected with *T. gallinae.*

The prevalence of ectoparasite is higher (73.40%) in adult than young (67.39%). This result are probably similar to Gosh *et al.,* (2014). Greater prevalence in helminth and ectoparasite due to shearing there nest and same habitat area that base line information are supported by Islam *et al.,* (2009).

5.3 Sex related prevalence of parasites in pigeons

The present outcome showes that sex of pigeon had an influence on the prevalence of helminth parasites. The present result, the higher prevalence of helminth parasites in farmed pigeon was in female (81.70%) than male (63.79%) which was a statistically significant. The present findings are in the agreement with the findings of Adang *et al.,* (2008) reported the sex specific prevalence rate of helminth was 60% in female and 55% in male pigeons. Khezerpour (2012) who recorded that the prevalence of helminth

parasites was significantly higher in female (65.62%) than male (34.47%) pigeons. The present investigation is not related to the results of Tanveer *et al.,* (2011) who reported the prevalence of *Capillaria* sp. was 72.7% in male and 60% in female and in my study it is no related to that. The outcome expressed that there was an impact of sex on the prevalence of protozoan parasites in pigeon. In the present observation the sex related prevalence of protozoan parasites was slightly less in male (29.31%) than female (28.04%) pigeons. These results are in the line with the observation of Nasreen *et al.,* (2014) who observed that females are more susceptible *Trichomonas* sp. than male. The present results are related to the results of Begum *et al.,* (2008) who reported that *Trichomonas gallinae* was higher in female (70.9%) than male pigeons (63.8%) and Islam *et al.,* (2013) who found that females (31.58%) are more prevalent than male (19.3%) for *Haemoproteus* sp. but in preceding to Saeed (2012) who found that male pigeons have more prone to infection than female. From that in study *Eimeria* sp. are prone to male than female.

The sex related prevalence of ectoparasites in farmed pigeons expressed the highest prevalence found in female (98.7%) than male pigeons (70.68%).There was catastrophic dimensional change in sex related difference found in the prevalence of *Columbicola columbae* and *Menacanthus* sp. but no significance difference in case of *Lipeurus* sp. The present observations support to findings of Adang *et al.,* (2009) who reported that female had a higher prevalence than male pigeons .however r, the equivalent l prevalence rate (60%) of ectoparasites in female and male pigeons was recorded by Adang *et al.,* (2009). Prevalence of *T. gallinae* infection varied in relation to sex. Although not statistically significant but higher rate of infection was detected in female pigeons (24.39%) than the male (20.68%) pigeons. The cause of higher prevalence of *T. gallinae* infection can not be explained exactly but it is supposed due to female sex hormones that make the individual more susceptible to any infection (Lloyd, 1983).

The crucial cause of greater prevalence of parasites in female pigeons cant be expressed but it can be thought that hormonal influence and stress may affect the immunity of female pigeon which may be responsible for more parasitized than male (Natala, *et al.,* 2009).

5.4 Intensity of parasitic infections in pigeon

The observation of the current reading revealed that the mean intensity of various parasites in pigeons. The intensity of helminth parasites found in this study is slightly less than related to the findings of Begum and Sehrin (2012). The highest intensity rate was found in *Raillietina* sp. (3.50±0.33) among the helminth parasites which are similar to the findings of Musa *et al.,* (2011) and Salam *et al.,* (2009) who recorded that the intensity of *Raillietina* sp. (16.08±5.5) was 46 the highest among helminth parasites. Among the ectoparasites, *Menopon* sp was found in higher infestation rate (33.18±0.71) which is very close to the findings of Nadeem *et al.,* (2007). The mean intensity of Menacanthus sp. (18.78±0.71) and Lipeurus sp. (23.33±0.49) were slightly higher than the findings of Musa *et al.,* (2011) who recorded 15.10±3.00 and 19.5±2.00 respectively.

The present investigation demonstrated that the mean intensity of most of the investigated parasites was significantly ($P<0.05$) different between young and adult pigeon but there was not significant ($P>0.05$) difference for *Raillietina* sp., *Columbicola columbae* and *Menopon* sp. Msoffe *et al.,* (2010) reported that there was significant age related difference for *Raillietina echinobothridia* and insignificant difference in case of *Ascaridia* galli.

It was shown that statistical comparison of mean intensity of various parasites per infected birds among female and male wast significantly different for helminth, protozoa and ectoparasites. It was seeking that differences of mean intensity between male and female were slightly higher. These results are in the line of Adang *et al.,* (2009) Musa *et al.,* (2009); Begum and Sehrin (2012) who recorded insignificant sex related difference in the intensity of ectoparasites and helminth parasites, respectively.

CHAPTER 6

CONCLUSIONS

The present study shows that pigeons have high prevalence of ectoparasite and endoparasiten. Infestation including some helminth and also protozoa. The intensity and prevalence is high due to relation to age and sex were studied it may significant at $P<0.005$. In my study eleven species are found such as, *Heterakis* sp., *Raillitiena* sp., *E. chinostoma* sp., *Ascaridia* sp., *Capillaria* sp., *Trichomonas* sp., *Eimeria* sp., *Colunbicola columbae, Menopon* sp., *Menacanthus* sp. and *Lipeurus* sp. Parasitic infestation is major problem of pigeon rearing, it causes great harm to the farmer due to economic loss. It is parlying or consulting that, precautionary measures should be taken to prevent parasitic infestation in this area as well as in the farmed pigeon.

REFERENCES

Abed A. A. A., Naji H. A. and Rhyaf A. G. (2014). Investigation study of some parasites infected domestic pigeon (*Columba liviadomestica*) in Al-Dewaniya city. *IOSR Journal of Pharmacy and Biological Sciences*; 9(4): 13–20.

Adang K. L., Oniye S. J., Ezealor A. U., Abdu P. A. and Ajanusi O. J. (2008). Ectoparasites of Domestic Pigeon (*Columba livia domestica,* Linnaaeus) in Zaria, Nigeria. *Research Journal of Parasitology*; 3(2): 79–84.

Adang K. L., Oniye S. J., Ezealor A. U., Abdu P. A., Ajanusi O. J. and Yoriyo K. P. (2009). Ectoparasites and intestinal helminths of speckled pigeon (Columba guinea Hartlaub and Finsch 1870) in Zaria, Nigeria. *Science World Journal*; 4(2): 1–5.

Al-Barwari S. and Saeed I. (2012). The parasitic communities of the rock pigeon *Columba livia* in Iraq Component and Importance. *Turkiye Parazitoliji Dergisi*; 36: 232–239.

Al-Rammahi H. M., AL-Hasnawy M. H. and Abba A. K. (2013). Concurrent Infection of Cestodes with Trichomoniasis in Domestic and Wild Columbides Birds in Babylon Province. *Iraq Journal of Veterinary Medicine.* 37(2): 192–198.

Bahrami A. M., Hosseini E. and Razmjo M. (2013). Important Parasite in Pigeon, its Hematological Parameter and Pathology of Intestine. *World Applied Sciences Journal*; 21 (9): 1361–1365.

Bahrami A. M., Monfared A. L. and Razmjoo M. (2012). Pathological study of parasitism in racing pigeons: An indication of its effects on community health. *African Journal of Biotechnology*; 11(59): 12364–12370.

Bahrami A. M., Omran A. N., Asbchin S. A., Doosti A., Bahrami A., Monfared A. L. (2011). Survey of egg per gram (EPG) parasite ovum in pigeon. *International Journal of Molecular and Cellular Medicine (IJMCM),* Research Article 9, 1(2): 103–106.

Basit T., Pervez K., Avais M. and Rabbani I. (2006). Prevelance and chemotherapy of nematodes infestation in wild and domestic pigeons and its effects on various blood components. *Journal of Animal and Plant Science*; 16: 1–2.

Begum A. and Sehrin S. (2011). Prevalence and seasonal variation of ectoparasite in pigeon, *Columba livia* (Gmelin, 1789) of Dhaka. *Journal of the Asiatic Society of Bangladesh, Science*; 38(1): 93–98.

Begum A. and Sehrin S. (2012). Gastrointestinal helminths in pigeon *Columba livia* (GMELIN, 1789). *Journal of the Asiatic Society of Bangladesh, Science*; 38(1): 93–98.

Begum N., Mamun M. A. A., Rahman S. A. and Bari A. S. M. (2008). Epidemiology and pathology of *Trichomonas gallinae* in the common pigeon (*Columba livia*). *Journal of Bangladesh Agricultural University*; 6(2): 301–306.

Borghare A. T., Bagde V. P., Jaulkar A. D., Katre D. D., Jumde P. D., Maske D. K. and Bhangale G. N. (2009). Incidence of Gastrointestinal parasitism of Captive Wild Pigeons at Nagpur. *Veterinary World*; 2(9): 343.

Cable R. M. (1957). An Illustrated Laboratory Manual of Parasitology. 4th edition. Burges Publishing Co. Minneapolis 15, Minnesota, USA.; 114–115.

Cheesbrough M. (1990). Medical Laboratory Manual for tropical countries. Second edition, University Press Cambridge.

Cooper J. E. (1984). A veterinary approach to pigeons. *Journal of Small Animal Practice*; 24: 505–516.

Dadi-Mamud N. J., Kabir M. A., Dibal D. M. and Rajab. M. H. (2012). Study on the Prevalence of Haemoparasites of Pigeon (*Columba livia*) in Lapai-Nigeria. *International Journal of Advanced Biotechnology and Research*, 4(1&2): 121–127.

Dey A. R., Begum N., Paul S. C., Noor M. and Islam K. M. (2010). Prevalence and Pathology of Blood Protozoa in Pigeons Reaered at Mymensingh District, Bangladesh. *International Journal of Bio Research*; 2(12): 25–29.

Doosti A., Ahmadi R, Mohammadalipour Z., and Zohoor A. (2014). Detection of *Haemoproteus columbae* in Iranian pigeons using PCR. International Conference on Biological, Civil and Environmental Engineering (BCEE-2014), Dubai (UAE).

Dranzoa C., Ocaido M. and Katete P. (1999). The ecto-, gastro-intestinal and haemo-parasites of live pigeons (*Columba livia*) in Kampala, Uganda. *Avian Pathology*; 28(2): 119–124.

Eljadar M., Saad W., Elfadel G. (2012). Study on the prevalence of endoparasites of domestic pigeons (*Columba livia domestica)* inhabiting in the Green Mountain Region of Libya. *Journal of American Science*; 8(12): 55-58.

El-Khatam A. O., Abou Laila M. R., Ibrahim M. and Abd El-Gaber M. M. (2016). *Trichomonas gallinae*: Prevalence and molecular characterization from pigeons in Minoufiya governorate. *Egyptian Experimental Parasitology*; 170: 161–167.

Fowler N. G. (1990). How to carry out a field investigation In: Poultry Disease, F. T. W. (Ed.) Bailliere Tindall, London. 370–400.

Ghazi R. R., Mansour N. K. and Bilqees F. M. (2006). Palluterina karachiensis sp. n. (Cestoda: Anaplocephalidae) from the wild pigeon *Columba livia* Gmelin. *Turkey Journal of Zoology*; 26: 27–30.

Ghosh K. K., Islam M. S., Sikder S., Das S., Chowdhury S. and Alim M. A. (2014). Prevalence of Ecto and Gastrointestinal Parasitic Infections of Pigeon at Chittagong Metropolitan Area, Bangladesh. *The Journal of Advances in Parasitology*; 1(1): 9–11.

Hazard F. A. (1922). Profitable pigeon breeding. American Pigeon Journal Company.

Hendrin C. M. and Robinson N. (2006). Diagnostic Parasitology for Veterinary Technicians (3rd Ed.), Mosby Inc. and affiliated of Elesevier Inc.; 255–260.

Islam A., Anisuzzaman, Kalam A., Rabbi M. A., Rahman A., Islam M. A. and Rahman M. H. (2013). *Haemoproteus* spp. Infection of Domestic Poultry of Bangladesh. VETSCAN; 7(2): 132.

Islam A., Trisha A. A., Das M. and Amin M. R. (2009). Retrospective study of some poultry diseases at Gaibandha district in Bangladesh. *Bangladesh Journal of Veterinary Medicine*; 7(1): 239–247.

Kabir M. A. (2014). Sexing in pigeons by phenotypic method. *International Journal of Advanced Research in Biological Science*; 1(5): 33–38.

Kabir M. A. (2015) Most Beautiful Pigeons of Bangladesh. *Animal and Veterinary Sciences.* 3(2): 34-37.

Kaminjolo J. S., Tikasingh E. S. and Erdinand G. A. A. (1988). Parasites of the common pigeon (*Columba livia*) from the environs of Port of Spain. *Trinidad Bulletin for Animal Health and Production*; 36: 194–195.

Kettle D. S. (1995). Medical and Veterinary Entomology (2nd Ed), CAB international; 371–376.

Khezerpour A. and Naem S. (2013). Investigation on Parasitic Helminthes of Gastrointestinal, Liver and Lung of Domestic Pigeons (*Columba livia*) in Urmia, Iran. *International Journal of Livestock Research*; 3(3): 35–51.

Kulisic Z. (1989a). Parasitical infection among pigeons (*Columba livia*) of different ages in the area of Belgrade. *Acta Veterinaria Beograde*; 39(2-3): 155–162.

Layla O., Elmajdoub and Mshiheet K. A. (2016). A Survey of Intestinal Parasitic Infection Among Domestic Pigeons in Misurata, Libya. The Third Symposium on Theories and Applications of Basic and Biosciences. 63–68.

Levine N. D. (1985). Veterinary Protozoology. 1st edition. Iowa State University Press, Ames.; 266–282.

Luna L. G. (1968). Manual of Histologic staining methods of the Armed forces Institute of Pathology. 3rd edition. Mc Graw Hill Book Co. New York.

Marques S. M. T., De Quadros R. M., Da Silva C. J. and Baldo M. (2007). Parasites of pigeons (*Columba livia*) in urban areas of lages, Southern Brazil. *Parasitología latinoamericana*; 62: 183–187.

McDougald L. R. (2003). In: Saif Y. M. (chief editor) ,Barnes H. J. , Glisson J. R., Fadly A. M. , McDougald L. R., and Swayne D. Diseases of poultry. 11th ed., Iowa state press, Ames, Iowa.; 1006–1008.

Msoffe P. L. M., Muhairwa A. P., Chiwanga G. H. and Kassuku A. A. (2010). A study of ecto- and endo-parasites of domestic pigeons in Morogoro Municipality, Tanzania. *African Journal of Agricultural Research*; 5(3): 264–267.Muhairwa A. P., Msoffe P. L. M., Ramadhani S., Mollel E. L., Mtambo M. M. A. and Kassuku A. A. (2007). Presence of gastrointestinal helminthes in free-range ducks in Morogoro Municipality, Tanzania. *Livestock Research for Rural Development*; 19 (4): 1–5.

Musa S., Afroz S. D. and Khanum H. (2011). Occurence of ecto- and endo parasites in pigeon (*Columba livia* Linn.) *University Journal of Zoology, Rajshahi University*; 30: 73–75.

Mushi E. Z., Binta M. G., Chabo R. G., Ndebele R. and Panzirah R. (2000). Helminth parasites of domestic pigeons (*Columba livia domestica)* in Sebele, Gaborone, Botswana. *Onderstepoort Journal of Veterinary Research*; 67: 75–76.

Mushi E. Z., Bintab M. G., Chaboa R. G., Ndebelea R . and Panziraha R . (2000). Parasites of domestic pigeons (*Columba livia domestica*) in Sebele, Gaborone, Botswana. *Journal of the South African Veterinary Association*; 71(4): 249–250.

Nadeem M., Khan M. N., Iqbal Z., Sajid M. S., Arshad K. and Yaseen M. (2007). Determinants influencing prevalence of louse infestations on layers of district Faisalabad (Pakistan). *Britrish Poultry Science*; 48(5): 546–550.

Natala A. J., Asemadahun N. D., Okubanjo O. O., Ulayi B. M., Owolabi Y. H., Jato I. D. and Yusuf K. H. (2009). A survey of parasites of domestic pigeon (*Columba livia domestica*) in Zaria, Nigeria. *International Journal of Soft Computing*; 4(4): 148–150.

Nath T. C., Bhuiyan M. J. U. and Alam M. S. (2014). A study on the presence of *Leucocytozoon*osis in pigeon and chicken of hilly districts of Bangladesh. *Biological Sciences and Pharmaceutical Research*; 2 (2): 13–18.

Nisar S., Khan M. F., Khan A., Azmi M. A., Mehboob U., Raza A. (2015). Histopathological changes of intestine of pigeon (*Columba livia*) artificially infected with *C. digonopora* and *C. cuneata*. *International Journal of Fauna and Biological Studies*; 2(3): 36–39.

Orajaka L J ,Nweze LC (1991).Prevalence of blood protozoan parasite of avian species in Nsukka Area of Anambra State , Nigeria. *Beitrge Tropischen Landwirtschaft Beterinarmedizin*; 29(1): 91–95.

Parsani H. R., Momin R. R., Lateef A. and Shah N. M. (2014). Gastro-intestinal helminths of pigeons (*Columba livia*) in Gujarat, India. *Egyptian Journal of Biology*; 16: 63–71.

Patel P. V., Patel A. I., Sahu R. K. and Vyas R. (2000). Prevalence of gastrointestinal parasites in captive birds of Gnjarat zoos. *Zoos´ print Journal*; 15: 295–296.

Piasecki T. (2006). Evaluation of urban pigeon (Columbia livia f. urbana) health status in relation to their threat to human's health. *Medycyna Wet*; 62: 531–535.

Pirali-Kheirabadi K., Dehghani-Samani A., Ahmadi-Baberi N., Najafzadeh V. (2016). A First Report of Infestation by *Pseudolynchia canariensis* in a Herd of Pigeons in Shahrekord (Southwest of Iran). *Journal of Arthropod-Borne Disease*; 10(3): 426–430.

Rabbi A. K. M. A., Islam A., Majumder S., Anisuzzaman and Rahman M. H. (2006). Gastro intestinal helmiths infection of poultry. *Bangladesh Journal of Veterinary Medicine*; 4(1): 13–18.

Radfar M. H., Norouzi Asl E., Seghinsara H. R., Dehaghi M. M., Fathi S. (2012). Biodiversity and prevalence of parasites of domestic pigeons (*Columba livia* domestica) in a selected semiarid zone of South Khorasan, Iran. *Tropical Animal Health Production*; 44(2): 225–229.

Sari B., Karatepe1 B., Karatepel M. and Kara M. (2008). Parasites of domestic (*Columba livia domestica*) and wild (*Columba livia*) pigeons in Nigde, Turkey. *Bulletin of the Veterinary Institute in Pulawy*; 52: 551–554.

Schesselman J. J. (1982). Case control studies. Oxford University press, Oxford. 174–177.

Senlik B., Gulegen E. and Akyol V. (2005). Ectoparasites of domestic pigeons (*C. l. domestica*) in Bursa Province. *Turkiye Parazitoliji Dergisi*; 29(2): 100–102.

Shaikh F., Ursani T. J., Naz S., Dhiloo K. H. and Solangi A. W. (2016). Histopathological changes in the intestine of infected pigeon (*Columbalivia*) naturally infected with helminth parasites from Hyderabad, Sindh Pakistan. *Science International* (Lahore); 28(6): 5273–5275.

Shinde N.G., Gatne M.L. and Singh A. (2008). Prevalence of parasites in pigeons (*Columba livia domestica)* of Mumbai. *Journal of Veterinary Parasitology*; 22(1): 65–66.

Silovsky G. D., Wight H. M., Sisson L.H., Fox T. L. and Harris S. W. (1968). Methods for Determining Age of Band-Tailed Pigeons. *Journal of Wildlife Management*; 32 (2): 421–424.

Sivajothi, S. and Reddy, B. S. (2015). A study on the gastro intestinal parasites of domestic pigeons in YSR Kadapa district in Andhra Pradesh, India. *J. Dairy Vet. Anim. Res.* 2(6): 10-15.

Sol D., Jovani R. and Torres J. (2000). Geographical variations in blood parasites in feral pigeons the role of vector – Ecography; 23: 307–314.

Soulsby E. J. L. (1982). Helminth, Arthropods and Protozoa of Domesticated Animals. 7th edition. Baillire, Tindalle; 35–740.

Springer W. T. (1997). Other blood and tissue protozoa edited by calnek B.W., Barnes H.J., Beard H.J., McDougald L.R. and Saif Y. M. In: Diseases of Poultry (10th edition) Iowa state University Press, U.S.A. 900–911.

Stenzel T. and Koncicki A. (2007). Occurrence of parasitic invasions in domestic pigeons (*Columba livia domestica*) in the Northern Poland. *Polish Journal of Veterinary Sciences*; 10(4): 275–278.

Stone R.M. (1982). Clinical examination and methods of treatment. In: M.L. Petrak (Ed.), Diseases of Cage and Aviary Birds, 2nd edn. Philadelphia: Lea and Febiger. 258–268

Tanveer M. K., Kamran A., Abbas M., Umer N. C., Azhar M. A. and Munir M. (2011).Prevalence and chemo-therapeutical investigations of gastrointestinal nematodes in domestic pigeons in Lahore, Pakistan. *Tropical Biomedicine*; 28(1): 102–110.

Tongson M. S., Sican V. and Trovela V. (1975). *Ornithostrongylus quadriradiaatus* (Stevenson, 1904) a hitherto unreported helminthes of domestic pigeons in the Phillipines. Philippine Journal of Veterinary Medicine; 14(1): 144–150.

Urquhart G. M. (1996). Veterinary Parasitology (1st Ed), ELBS, Longman House, Burnt Mill, Harlow, England.; 256–257.

Urquhart G. M., Armour J., Duncan J. L., Dunn A. M. and Jennings F.W. (2000). Veterinary Parasitology, second ed. Blackwell publishing, United Kingdom.

Wall R. and Shearer D. (1997). Veterinary entomology (1st Ed), Chapman and Hall, London, U. K. 284–311.

Zwart P. (1993). Columbriform medicine. In: M.E. Fowler (Ed.), Zoo and Wild Animal Medicine: Current Therapy 3, 2nd edn. Philadelphia: Saunders Company. 240–244.

APPENDIX

QUESTIONNAIRE

1. **Information of the owner:**
   i. Name ……..... Village:…….....
   ii. Upazila ……... District…….....
   iii. Mobile no……
2. **History:** Vaccinated: ☐ Non Vaccinated ☐
   a. Anthelminthic: Yes ☐ No ☐
   b. Color of Diarrhoea: Bloody ☐ Others ☐
3. **About of birds (pigeon):**
   a. Sex: Male ☐ Female ☐
   b. Age: Young ☐ Adult ☐
   c. Color:
   d. Breed:
4. **Eye Observation:** Healthy ☐ Sick ☐
5. **Sample:** Faeces ☐ Tracheal Swab ☐ Blood ☐ Ectoparasite ☐
6. **Laboratory Findings:**

Date: …….
Signature of Investigator