PREVALANCE OF GASTROINTESTINAL HELMINTHS OF TURKEYS IN WET MARKETS OF DHAKA CITY

A Thesis

BY

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MASTER OF SCIENCE IN PARASITOLOGY

DEPARTMENT OF MICROBIOLOGY AND PARASITOLOGY

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CERTIFICATE

*This is to certify that thesis entitled, "**PREVALANCE OF GASTROINTESTINAL HELMINTHS OF TURKEYS IN WET MARKETS OF DHAKA CITY** " submitted to the **Faculty of Animal Science & Veterinary Medicine**, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in PARASITOLOGY**, embodies the result of a piece of bona fide research work carried out by **NUSRAT JAHAN NIPU**, Registration No. **12-05010** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that such help or source of information, as has been availed of during the course of this investigation, has duly been acknowledged.

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The Author

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ACRONYMS AND ABBREVIATIONS

ABBREVIATION		FULL MEANING
et al.	=	And others/Associates
FAO	=	Food and agriculture organization
FAOSTAT	=	Food and Agriculture Organization Corporate Statistical Database
NRC	=	Nuclear Regulatory Commission
GNP	=	Gross national product
M.S.	=	Master of Science

PREVALANCE OF GASTROINTESTINAL HELMINTHS OF TURKEYS IN WET MARKETS OF DHAKA CITY

ABSTRACT

Gastrointestinal nematodes constitute a major impediment to efficient poultry production, including turkeys and leading to substantial economic losses. Here, we studied the helminths of turkey from different market areas of Dhaka city in Bangladesh. The gastrointestinal helminths were investigated from a total 50 turkeys (*Meleagris gallopavo*). The samples were collected from Gonobissobiddaloi (30), Mohammadpur Town Hall Kacha Bazar (15) and Agargoan Bazar (5). The overall prevalence of helminth infection was 74%. The nematodes detected in turkeys were *Heterakis gallinarum* (62%) and *Capillaria philippinensis* (74%). Of the two helminth species, *C. philippinensis* is reported to have zoonotic potentialities. The farmers have been rearing the turkeys very close to the human habitat. Therefore, turkey farmers, meat sellers and consumers are at risk of being infected with *C. philippinensis*. To the best of our knowledge, the study on helminths in turkey is going to be reported for the first time in Bangladesh. Therefore, further proper attention should be paid for more comprehensive investigation with large samples to discover zoonotic helminth in Bangladesh.

CHAPTER 1

INTRODUCTION

Bangladesh is a small country with a large population about 160 million, situated between 88º10' and 92º41' East longitudes and between 20º34' and 26º38' North latitudes in south Asia with flat land area (147,570 sq.km). Traditional backyard poultry keeping has been practiced in this country since time immemorial. It is reported that the worldwide poultry sector consists of chickens (63%), ducks (11%), geese (9%), turkeys (5%), pigeons (3%) and guinea fowls (3%) Besbes (2009). From the last decade, demand for poultry products has been increased rapidly in Bangladesh, and propelled by rising levels of income, population and urbanization. Experience shows that climate of Bangladesh is convenient to rear different poultry species. Begum *et al*., 2011 reported that, poultry meat alone contributes 37% of the total meat production in Bangladesh. Poultry transform feed into animal protein very rapidly. Poultry consumption in developing countries is projected to grow at 3.4% per annum to 2030, followed by beef at 2.2% and ovine meat at 2.1%. In the world as a whole, poultry consumption is projected to grow at 2.5% per annum to 2030, with other meats growing at 1.7% or less (FAO, 2007).

The environmental impact of poultry production is a continuing challenge and it is predicted that global consumption of poultry meat will increase between 2000 and 2030 at an average annual rate of 2.51% (Fiala, 2008). In fact, poultry keeping is an integral part of the rural household that provides family income for the small, marginal and landless poor. The farmers who cannot afford to rear cattle and goat can easily rear poultry. However, among the livestock sector, the poultry industry (specially, commercial broiler and layer) is in the line to be destroyed due to severity of avian influenza (bird flu). Thus, it is crying need to search the alternative protein source to meet up the increasing demand. Variable options need to be explored and evaluated in order to maximize food production and meet protein requirements in developing countries (Owen *et al*., 2008). Turkey meat may be a one of the best options for alternative protein source in Bangladesh. Turkey production is an important and highly profitable agricultural industry with a rising global demand for its products (Yakubu *et al*., 2013). They are adaptable to wide range of climatic conditions (Ogundipe and

Dafwang, 1980). Karki (2005) stated that consumption of turkeys and broilers as white meat was rising worldwide and a similar trend also existed in developing countries. In the whole world, total production of turkey meat was 5.6 million ton in 2012, which was higher than 5.1 million ton in 2003, a decade earlier (FAOSTAT, 2012). Turkey is an excellent insect forager and most crops that are troubled by insect population including vegetables are candidates for insect control by turkeys (Grimes *et al*., 2007).

In many countries in the world, poultry has become one of the most popular components of the livestock industry. The domestic turkeys (*Meleagris gallopavo)* are one of the most important and widely distributed game bird species in Northern America, Europe. But, in the rest of the world, especially in developing countries, it's potential has been overlooked largely because modern turkeys are highly breed for intensive production, thereby rendering the birds in appropriate for home production (NRC, 1991). Yakubu *et al*. (2013) stated that turkey thrives better under arid conditions, tolerates heat better, ranges farther and has higher quality meat. But turkey production has not been fully exploited in Bangladesh, including other developing countries despite its huge potential over other poultry species. In fact, turkey is a newly introduced poultry species in Bangladesh. Farmers are rearing turkey as an ornamental bird with a limited extent without having prior experience. Mainly interested farmers started turkey farming by importing day-old turkey chicks (Poult) from neighboring country, India.

The popularity of turkey meat is increasing gradually because of gamey flavor with lower fat content. So, it may have high potential for production and marketing in Bangladesh. Turkeys are large poultry birds, fast gaining popularity among peasant farmers in due to their quick turn over rate, higher feed conversion rate and minimum land requirements. The turkeys compliment chicken production. They are said to thrive more in arid conditions, they tolerate heat as compared to chickens. Their males are bigger than the female turkeys. The carcass of turkeys contains a higher amount of protein than the carcass of chicken (Smith 1990 and Oso *et al*. 2008). Domestic turkeys are omnivores, feeding on ground dwelling arthropods, molluscs and amphibians, vegetables, nuts, seeds and leaves (Eaton, 1992). But gastrointestinal helminths constitute a major factor limiting productivity of the poultry industry by affecting the

growth rate of the host resulting in malnourishment which could eventually lead to death (Soulsby, 1982; Jordan & Pattison, 1999). Helminth that commonly infect the gastrointestinal tract of the turkeys include nematodes, cestodes and trematodes (Soulsby, 1982). These parasites when found in the gastrointestinal tract could lead to loss of appetite, emaciation, diarrhea, anaemia reduced egg production, retarded growth and therefore, reducing their economic value. A few ascarid may depress weight while large numbers may block the intestinal tract. *Ascaridia dissimilis* (turkey roundworm) may also migrate out of the intestine through the portal system into the liver thereby causing hepatic granulomas (Gordon, 1997). The demand for protein as a vital component of nutrients is very important.

Poultry production is the most efficient and economic means of meeting this demand; due to the relative small capital required to start off, the ease of feed availability and the fast maturity of the birds. Despite the importance of turkey in meeting the demand for protein, effects of parasites on the domestic turkeys is poorly understood. Modern confinement rearing of poultry has significantly reduced the frequency and variety of these endoparasite infections which are common in free-range birds and backyard flocks. However, severe parasitism still may occur in floor-reared layers, breeders, turkeys, or pen-reared game birds. Multiple helminthiasis is common in poultry kept extensively, while heavy infections are common in intensively managed stock in which they cause severe pains that affect the normal activities of the birds resulting to death. In addition, the role of poultry worms such as *Heterakis gallinarum* has been associated with the transmission of *Histomonas meleagridis* in turkeys and chicks. It has been reported that parasitic infections or their concurrent infections result in immunosuppression, especially in response to vaccine against some poultry diseases. Chicken, duck and turkey are most birds that are kept as domestic bird in rural environments.

The gastrointestinal tract plays an important role in digestion and absorption of foods so any changes in intestinal health and digestion due to lack of proper absorption of food and the growth performance and production will be disrupted. Bacterial, viral, parasitic and some non-infective agents such as management problems and nutritional deficiencies can cause intestinal problems in turkeys (Hafez, 2011).

There are risk factors of parasitic infection (including protozoa, arthropods, worms, etc) in rural poultry because they are in contact with outdoor environments. *Capillaria* is a nematode of small intestines of domestic and wild birds such as chicken, turkey, geese, duck, guinea fowl that cause weight loss, diarrhea and economic losses in severe infections (Hogue *et al*. 2014). *C. philippinensis* infection is frequently found in the Philippines and Thailand. Some cases have been found in other Asian countries, the Middle East, and Colombia. *C. philippinensis* is often found in the tissues of small, freshwater fish. When humans ingest these raw or undercooked infected fish, larvae migrate to the intestine and mature to adult worms. Female worms deposit eggs in the intestine, which are released in fecal matter. When infected human fecal matter reaches freshwater, fish can become infected and the cycle continues. Some eggs hatch within the human intestine causing hyperinfection. *Ascaridia gali* is a nematode of small intestines of domestic and wild birds which has world-wide distribution and in severe infections causing diarrhea, decreased egg production, emaciation and anemia (Yadav *et al.,* 1991). Echinostome trematode of small intestine of birds and the infections are in areas of the world where there are suitable conditions for the growth of intermediate host (snails). *Raillietina tetragona* and *Raillietina echinobothrida* are parasites in the small intestines of birds (including chicken, turkey, quail and pheasant) and these infections have been spread worldwide (Vattanodorn *et al*. 1984).

Poultry production has remained the main stay of the livestock production industry and a major contributor to the economy and the gross national product (GNP). It is however unfortunate that currently, there is a paucity of information regarding the prevalence of endoparasites of chickens and turkeys in study area, despite its numerous importance. For a fast growing economy, however, there is a need to continually revalidate existing data on the health of chickens and turkeys at regular intervals. In addition, as co-factors in other poultry diseases, the knowledge of their prevalence is essential in understanding the epidemiology control measures. Thus a comprehensive report of blood and gastrointestinal parasites of chickens and turkeys should be based on field surveys and experimental researches. In spite of the fact that poultry production is fast growing and becoming a major enterprise. Therefore, adequate information on the prevalence of these parasites, their control and management practices adopted are vital,

since such information could be useful to commercial and local poultry farmers. However, there is scanty study conducted previously regarding turkey production in Bangladesh.

Therefore, the present study was aimed to identify the helminths through detail morphological characteristics and to study their prevalence that infect the turkey and cause various types of detrimental efftects which is constrain for turkey production.

CHAPTER 2

REVIEW OF LITERATURE

Udoh *et al*. (2014) conducted a study on prevalence of gastrointestinal parasites of the domestic turkey (*Meleagris gallopavo*) in Kaduna metropolis, Kaduna State, Nigeria. The gastrointestinal tracts of 196 Turkeys comprising 114 males and 82 females were examined for gastrointestinal parasites. The gastrointestinal tracts were collected from five slaughter slabs in Kaduna. The overall prevalence of the parasitic infection is shown that, Out of a total of 196 domestic turkeys examined, 113 (57.7%) were infected by protozoans, nematode and cestode parasites. Nematodes had the highest prevalence of 61(31.1%), followed by protozoans 44 (22.4%), cestodes had the least prevalence of 8(4.0%). The parasites with the highest prevalence was *Ascaridia spp* 51 (26.0%), followed by *Eimeria* 44 (22.45%), *Subulura brumpti* 7(3.6%) *Raillietina cesticillus 5*(2.6%), *Heterakis gallinarum* 2(1.0%) *Choanotaenia infundibulum, Davainea meleagridis*, *Methroliasthes lucida* and *capillaria spp* had the least prevalence of 1(0.5%). Higher prevalence was recorded in males (62.3%) than females (47.6%). Double infection was more common (32.1%) than single infection (22.9%), triple (26.02%), quadruple (13.1%) and pentaple infection had the least (5.1%). Based on the prediction sites, small intestines harboured more parasites. No parasite was recovered in the proventriculus. The occurrence of parasites in the Turkey is the most damaging infection and source of high economic losses in the industry through meat condemnation and morbidity (Naem and Eskandari, 2005).

The high prevalence recorded in this study could be due to the fact that domestic turkeys are natural forages that can be fed with a wide range of diet that predispose them to parasitic infections with many of the foods such as seeds, kitchen wastes exposing them to the intermediate hosts (such as cockroaches, beetles, grasshopper, earthworms etc.) of certain pathogens (Frantovo, 2000). A feature of this study was the complete absence of trematodes in the gastrointestinal tracts of the domestic turkeys. This could be due to the complex life cycle of the trematodes that requires at least an intermediate host which may be in the same habitat with the turkeys. The absence of such habitats helps to break the lifecycle of the trematodes thereby reducing the spread of the worms (Adang *et al*. 2008). Over the years, turkeys were only raised under

semi intensive conditions by only the rich in Nigeria or their personal consumption. Until recently when more individuals could afford raising these birds in their backyards which to a great extent has increased the chances of the turkeys to harbor more gastrointestinal parasites. In addition to that, a considerable amount of human and animal wastes are discharged into the soil daily thereby leading to seeping of the soil with pathogenic organisms, contamination of the soil occurs and eventually infective stages are swallowed by the birds during feeding (Audu *et al*. 2004). The species specific prevalence of the parasites in this study revealed higher prevalence in males than female turkeys. This outcome could be due to the fact that female turkeys reduces their feeding range during incubation period and concentrate more on the grains and food remnants being served to them, thereby reducing the chances of acquiring infection. The males on the other hand can go far in search of food, thereby increasing the possibility of picking more parasitic eggs (Adang *et al*. 2008).

Nematodes had the highest prevalence as compared to cestodes, with *Ascaris* having a prevalence of 26.0%. This work agrees with earlier findings of Yoriyo *et al. (*2008); Ohaeri and Okwum, (2013) which indicates that nematode parasites are always more prevalent than the cestodes. The nematodes do not require intermediate hosts as the cestodes do and are mostly soil transmitted, their eggs can remain viable for a long time enabling the turkeys to constantly pick up the viable eggs from the droppings that contaminate the environment as they feed and increase parasite burden. (Permin and Hansen, 1998; Ohaeri and Okwum, 2013). The domestic turkeys raised in backyards are hosts of a greater amount of gastrointestinal parasites. This partly explains the low productivity that is common in raising turkeys, which confers greater resilience inherent to the production system to which they belong (Marco-Antonio *et al*. 2014). Poor sanitary condition and lack of proper hygiene is a major contributing factor to the high prevalence recorded in this study. Most backyard farmers don't bother about keeping their gutters and surrounding clean this exposes the birds to serious infection. Not much have been documented on gastrointestinal parasites of domestic turkeys in Nigeria and Africa. The study would therefore serve as a reference point for further studies. Mixed infections of two or more species of parasites per turkey were common in this study but lower prevalence of mixed infections was recorded as compared to the single

infection. This outcome might be attributed to the food preference at a particular time which to a great extent can determine the establishment of mixed or single infection. The ability of two or more parasites to survive within the same host has increased the prevalence of mixed infection but as the number of parasites per host increases, the prevalence decreases due to the inability of the parasites to tolerate one another. (Reid,. 1962; Smyth, 1976; Fatihu *et al.* 1991). Most of the parasites encountered in this study were restricted to the small intestine where prevailing optimum concentration of saline, glucose and other semi digested food and debris abound (Adang *et al*. 2008) the site generally favour absorption of nutrients through the body surface of the parasites. In addition to that, some nematodes like *Subulura brumptiand* and *Heterakis gallinarum* were restricted to the large intestine and caecum. This might be attributed to their fairly developed digestive system that gives them greater chances of establishment of a host-parasite relationship. The complete absence of parasites in the proventriculus might be due to the fact that the physiological medium in the site do not favour the existence of parasites as compared to the small intestine.

In 2014, during February and March, from many villages of Amol city, Iran 60 native turkeys that these were slaughtered .Where these gastrointestinal tract was examined for evaluation the prevalence of helminth in turkey. The gastrointestinal tracts of turkeys were isolated completely after slaughtering. To prevent mixing of the contents of intestines, beginning and end of crop, stomach, gizzard, small intestine, large intestine and cecums were tied and transferred to laboratory for examination. At autopsy, each segment was oppened with a fine scissor and placed in separate petri dishes containing normal saline. The contents were washed with distilled water through a strainer while the deposits were transferred to petridish for examination. The mucosa was scrapped in order to collect the embedded worms in the mucosal layer of crop, proventriculus, gizzard and intestines. Isolation of gizzard worm was preceded by peeling off the keratin layer. All worms were picked, recorded and stored in universal bottles containing alcohol-glycerine. All helminths were identified by morphological characters according to the description of Soulsby (Soulsby,1982). After staining with acetocarmine, slides were observed by light microscope to identify the heminth parasites (nematode, trematode, cestode). Daryoush (2014) reported that 25% of the samples were not contaminated and 75% of samples were infected with nematode,

cestode and trematode. Prevalence and parasite species, including: 20% *Capillaria,* 51% *A. gali*, 8% *R. tetragona*, 8% *R. echinobothrida* and 11% *Echinostoma.* The results indicated that the highest prevalence of helminth parasites in turkeys of Amol and north of Iran was nematode. Eslami *et al.* (2008) reported 96% of domestic poultry in Golestan province, Iran and near to Caspean sea were infected with at least one of the parasites. Also, Radfar *et al.* (2011) reported that 93.23% native chicken in Sistan province (Iran) were infected with 10 species nematodes, cestodes and ectoparasites. The nematodes recovered were *Ascaridia gali* and *Capillaria spp*. The cestodes recovered were *R. tetragona* and *R. echinobothrida* and the trematode recovered was *Echinostoma spp*.

Dauda *et al*. 2016 conducted a study on Prevalence of Gastrointestinal Nematodes and Associated Risk Factors in Domestic Turkeys (*Meleagris gallopavo*) Slaughtered in Poultry Markets in Bukuru – Jos, Plateau State, Nigeria. They selected 400 domestic turkeys gastrointestinal tract, comprising of 247 adults and 153 young. Turkeys were collected from three poultry dressing slabs within Bukuru – Jos metropolis and were examined for the presence of nematodes. Out of which 254 are males and 146 are female turkeys. Out of the total number of turkey examined, 273(68.25%) were found to habour different species of gastrointestinal nematodes. Seven (7) nematode species were recovered in the examined visceral of the infected turkeys at different predilection sites. *Ascaridia* species (26.75%) was the most prevalent nematode and was recovered from the small intestine of infected turkeys; *Capillaria* species (20.50%) were found in the Oesophagus and small intestine, *Subulura brumpti* (8.50%) was found in the large intestine, *Heterakis gallinarum* (5.25%) were found in the Caecum, *Dispharynx nasuta* (4.0%) was found in the Proventriculus, *Strongyloides* species (2.50%) was also found in the small intestine and Caecum while *Cheilospirura spinosa* (0.75%) was the least prevalent nematode and was found in the Gizzard of infected turkey. Young (37.0%) turkeys had a significantly higher nematode infection rate ($P<0.0001$) compared to the adult turkeys (31.25%) (df = 1; OR= 0.5232; $P<0.0001$). Moreover, the infected males (49.0%) also showed a significantly higher nematode infection rate (P= 0.0307) compared to the infected female (19.25%) turkeys (df= 1; OR= 0.6835; P= 0.0307). Out of the 273 infected turkeys, 190 (47.50%) were infested with single species of nematode while 83 (20.75%) were infested with two or more species of nematodes.

Worm Infestation with single nematode was significantly higher (P<0.0001) compared to mixed infestation of nematodes in infected turkeys (df= 1; OR= 0.4368; P< 0.0001).

During April and May 2001, 49 wild turkeys collected as spring sample from several localities across the eastern half of Kansas. A large portion of this sample (46 birds) came from the Kansas Governor's One-Shot Turkey Hunt (Butler County, Kansas; April 11-13, 2001). From October 2001 to February 2002, 23 birds were collected as fall sample. In total, 50 adult and 22 juvenile turkeys were examined, most of which (69 of 72) were male. The spring sample consisted of 49 males, five of which were juveniles. The fall sample was comprised of three juvenile females and 10 juvenile males. All birds were collected by the use of firearms. Viscera were removed from recently killed wild turkeys, placed in plastic bags, covered with 1 liter of boiling water, and agitated to relax the helminths. One hundred milliliters of formalin then was added to fix and preserve the parasites. Intestines were opened with a longitudinal incision, and the contents were washed through a series of stacked sieves, with the final sieve as described by Kalla *et al.*

The contents of each sieve were examined for helminths with a microscope. Bush *et al*. J. W. Mc Junkin *et al.* reprted one acanthocephalan (*Mediorhynchus grandis*), two trematode (*Echinoparyphium recurvatum* and *Echinostoma revolutum*), one nematode (*Heterakis gallinarum*), and four cestode (*Metroliasthes lucida, Imparmargo baileyi, Raillietina sp.* and *Choanotaenia spp*) were found in the spring sample. Of these species, only the two trematodes (*Echinoparyphium recurvatum* and *Echinostoma revolutum*) and two of the cestodes (*Metroliasthes lucida* and *Raillietina sp*.) were present in the fall and winter sample. The life cycle of *H. gallinarum* is direct, with embryonated eggs being ingested by the definitive host. *Heterakis gallinarum* was found only in the spring sample, with relatively low mean in- tensities. Finding *H. gallinarum* in Kansas wild turkeys is, however, of some importance to wildlife managers. *Heterakis gallinarum* is the vector for *Histomonas meleagridis*, which causes blackhead, a common galliform disease resulting in necrosis of the cecal mucosa, swelling of the ceca, and liver necrosis.

During the period from June 2015 to May 2016, intestinal tracts of domestic pigeons (*Columba livia domestica*) and domestic turkeys (*Meleagris gallopavo*) were examined

in Beni-Suef province, Egypt to detect their helminth fauna. A total of 740 intestinal samples from pigeons and 100 from turkeys were investigated. El-Dakhly *et al*. (2016) reported that out of 740 examined pigeons and 100 turkeys, 87 (11.76%) and 6 (6%), respectively were infected with intestinal helminths during the period from June 2015 to May. The overall prevalence of recovered helminths was 11.76% (87/740) in pigeons. The recovered species were identified as two trematodes, 5 cestodes and 4 nematodes. Digeneans were *Brachylaima cribbi* (1/740; 0.14%) and unidentified *Brachylaima sp*. (0.14%). Cestodal species were identified as *Raillietina echinobothrida* (33/740; 4.46%), *Raillietina cesticillus* (7/740; 0.95%), *Raillietina tetragona* (7/740; 0.95%), *Cotugnia digonopora* (5/740; 0.68%) and *Hymenolepis carioca* (2/740; 0.27%). Among cestodes, *R. echinobothrida* was the most predominant one. Recovered nematodal species were *Ascaridia columbae* (22/740; 3%), *Subulura brumpti* (6/740; 0.81%), *Heterakis gallinarum* (3/740; 0.41%) and *Capillaria spp.* (2/740; 0.27%). *Ascaridia dissimilis* was the only helminth species detected in turkeys (6/100; 6%). The highest prevalence of infection was seen in winter and summer. Tapeworms and round worms were highly prevalent at the summer. The recorded trematodal infection was found in winter.

Brener *et al*. (2006) studied the lesions caused by the gizzard nematode *Cheilospirura hamulosa* (Diesing, 1851) in turkeys from Brazilian backyard flocks. This study was conducted with the prevalence and induced pathology of two helminth species, the intestinal nematode *Heterakis gallinarum* (Schrank, 1788), the renal digenetic trematode *Paratanaisia bragai* (Santos, 1934) Freitas, 1959, and the protozoan *Histomonas meleagridis* (Smith, 1895) in Brazilian turkeys. The prevalence of infection related to the association of *H. gallinarum* with the pleomorphic flagellate *H. meleagridis* was of 2.5% and the hepatic gross lesions consisted of solid nodules, appeared as whitish masses, whereas other histological findings were represented by severe and extensive granulomatous inflammatory process. The infiltrate presents a great amount of giant multinucleate cells, macrophages, epithelioid cells, lymphocytes and heterophils around small clear areas with round eosinophilic parasites identified to trophozoites of *H. meleagridis*; extensive parenchymal necrotic areas were also very outstanding. In the cecum trophozoites of *H. meleagridis* were distributed among a severe inflammatory process extending from the mucosa to the muscular layer

presenting a great amount of lymphocytes, macrophages and heterophils. In the case of the renal trematode *P. bragai*, the prevalence of infection was of 20% with a range of infection of 1-209 worms (from one of the kidneys only) and a mean of 38 parasites.

During the 1997-98 fall hunting season, samples from 154 Wild Turkeys were donated by hunters to the Nebraska Game and Parks Commission (NGPC) Genetic and Forensic Laboratory. Assistance was provided by the Veterinary Diagnostic Center, and the Harold W. Manter Laboratory of Parasitology, University of Nebraska, Lincoln, for this survey of infectious diseases and internal parasites. One hundred and thirteen sinus swabs were cultured for pathogenic bacteria, and fecal samples were examined for parasite ova and protozoa. One hundred and six gastrointestinal samples were examined for helminth parasites. Intestinal coccidiosis was present in 42 birds. Salmonella was isolated from fecal samples from four birds. Mycobacterium avium (avian tuberculosis) infection was suspected in one bird. No evidence of *Pasteurella multocida* (fowl cholera) or *Histomonas meleagridis* (blackhead) were seen. Thirty-three species of helminth parasites belonging to 4 taxa were identified: 13 species of cestoda, 12 species of nematoda, 7 species of trematoda, and 1 species of acanthocephala. Four helminths, not previously documented in North American Wild Turkeys, but known to exist in Europe, were identified in these birds.

From May 2004 to October 2005, 40 adult turkeys, 19 males, 21 females, weighting between 950-8,870 g, obtained from backyard flocks of different states and cities of Brazil were investigated for helminths in the digestive tract. After individual clinical evaluation, birds were killed and submitted to necropsy in accordance to the technique of Zander *et al*. (1997). Organs were opened in Petri dishes containing 0.85% NaCl solution. Sections of the parasitized organs were removed and immediately fixed in 10% buffered formalin, to be further routinely processed for paraffin embedding. Five micrometers thick sections were stained with hematoxylin and eosin (HE). The recovered nematodes were counted under a stereomicroscope Thirty-three (82.5%) out of 40 turkeys were positive for *capillariid* worms. Gross lesions were not detected in animals either infected with *B. obsignata* or *E. annulatus. B. obsignata* was mostly found in the small intestine and was observed in 29 turkeys (72.5%) and in two out of these worms were also present in the large intestine. The mean intensity of infection

was of 68.6 worms in a range of 2-461 parasites. The turkey with the highest worm burden (461) was an adult female specimen (from Rio de Janeiro, RJ), weighting 4,300 g, followed by younger animals, two males (from Niterói, RJ) weighting 950 g and 1,150 g, with 314 and 197 worms, respectively. In the animal with the highest worm burden, it was observed, mainly in the area of the intestinal crypts, in addition to portions of the parasites among the villi, thickening of the villi, together with a mild mixed inflammatory infiltrate, in the presence of mononuclear cells and heterophils were also observed. Five specimens of *E. anullatus* were recovered in the upper digestive tract and in the crop of a single young female (from Maricá, RJ), weighting 1,500 g. This finding represented a prevalence of 2.5%. Infiltrating heterophils were seen in the crop epithelium, with the presence of parasite eggs among these leucocytes that were filling tunnels lined with keratin. In the esophagus, heterophils foci were observed, in the absence of eggs or parasite debris. *C. anatis* (Schrank, 1790) Travassos, 1915, although present in 22.5% of the animals, with a mean intensity of 31.8 and a range of infection of 16-91 worms, was not pathogenic to the investigated birds. Co-infections with *B. obsignata* and *C. anatis* were observed in 12.8% of the turkeys.

In west of Iran between December 2011 and December 2012 a total 451 fecal samples were collected from the bird where no of turkey was (n = 59). Fecal samples from each decorative bird collected from the bottom of each birdcage. For other birds, we used plastic covers that lay on the floor in birds' nests and obtained fecal samples from it. Samples collected in labeled, leak-proof, and clean plastic stool cups and brought to the laboratory immediately. In total of 451 fecal samples examined 157 (34.8 %) were intestinal parasitic infections positive. The prevalence of parasites species identified in urban birds. Badparva (2014) reported four helminthes species were recovered and these involved two nematodes and two cestodes. *Raillietina spp*. was the most common helminthic parasite detected (4.2 %), followed by *Capillaria spp*. (2.4 %), *Ascarida spp*. (0.4 %) and *Hymenolepis nana* (0.2 %). *Cryptosporidium spp.* was the most common protozoan parasite detected (7.3 %), followed by *Eimeria spp*. (7.1 %), *Histomonas spp.* (6.5 %), *Trichomonas gallinae* (5.8 %) and *Amoeba spp*. (0.9 %). The most infected birds were sparrow (52.4 %), hen (34.8 %), turkey (28.8 %), decorative Birds (18.3 %) and pigeon (16.2 %), respectively. Mixed infections were found in 5.7 % of the birds, while 94.3 % had single infections. Among the mixed infections, 66.7

% had two species and 33.3 % had three species of parasites. Total turkey was 59, where prevalence was almost 29%. Protozoal infection was high (27%). One hundred and thirteen fecal flotation examinations were conducted. Forty-two (37%) were positive for coccidial oocysts. The oocysts were not determined to species. Three fecal samples contained double-operculated ova consistent with the nematode *Capillaria spp*. (Hurst *et al*. 1979). The causative agent of histomoniasis, *Histomonas meleagridis* (6.5 %), is transmitted within a flock by direct lateral transmission (Hu and Mc Dougald 2003). Histomoniasis (blackhead disease) mainly affecting the liver and caeca of birds. The severity of the disease varies over the different species. In turkey flocks, for example, mortality can be very high, whereas in chickens the symptoms are generally less severe (Mc Dougald 1997). In normal conditions, there are two ways by which birds become infected with *H. meleagridis:* the ingestion of embryonated eggs of a caecal worm (*Heterakis gallinarum* as the protozoan has a unique association with the worm) which acts as the vector and through 'cloacal drinking', where protozoa which have been shed in the faeces are taken up by the cloaca (Powell *et al.* 2009). Nevertheless in current study we didn't seen *H. gallinarum*. Well as we not found *H. meleagridis* and most prevalence of histomoniasis are related to hen population (11.9 %). Some species that appear to be common in other countries were not found in this area. Reasons might be the geographical variations in the distribution of the parasites or the intermediate hosts of the parasites and sampling.

From January to March, different poultry farms in Owerri, the tropical rainforest zone of southeastern Nigeria, male and female sexes of 5040 chickens and 560 turkeys were purposively randomly selected. Blood and faecal samples were taken from each of the birds randomly selected from the wing vein and per rectum respectively and examined for parasites, using standard parasitological techniques. Thin smear was prepared from the blood, stained with Giemsa and observed microscopically at ×100, using oil immersion. The fecal samples were subjected to both the simple floatation and sedimentation methods to observe the helminth ova and oocyts in them. The slides were thereafter examined under the microscope at ×10 magnification. Data obtained for blood and gastrointestinal parasites were analyzed using simple descriptive statistics. M. N. Opara *et al.* reported that out of 5600 birds examined, 5040 (90%) were chickens and 560 (10%), turkeys. Of the birds examined, 672 (12%) were infected with blood

parasites and 1792 (32%) infected with gastrointestinal parasites. Haemoparasites infection in chickens was 448 (8.9%) and 224 (40%) in the turkeys. Gastrointestinal parasites yielded 1456 (28.9%) prevalence rate in chickens, while 336 (60%) of the turkeys examined were infected. Out of 1232 (24.4%) cockerels examined, 224 (18.2%) of them were infected with haemoparasites and the same number of them (224, 18.2%) were infected with GI parasites. Of the 3808 (75.6%) hens examined, 224 (5.9%) and 1232 (32.4%) of them were infected with blood and GI parasites respectively. The results showed that, of the 336 (60%) male turkeys examined, 112 (33.3%) were infected with blood parasites, while the same number of them, (112, 33.3%) harboured GI parasites. Female turkeys examined were 224 (40%). The population of these that were infected was 112 (50%) and 224 (100%) for blood and GI parasites respectively. The prevalence of blood parasites of chickens reared in Owerri, the tropical rainforest zone of southeastern Nigeria. Out of 5040 chickens examined, 448 (8.9%) were infected with *Leucocytozoon sp*. This was the only blood parasites encountered among the chickens in this study. Plasmodium sp. was observed in the blood of the turkeys examined and 224 (40% of them were infection with this haemoparasite. Of the chickens examined in the study, 1232 (24.4% were infected with *Ascaridia sp.,* while 224 (4.4%) were infected with *Raillietina sp.* Out of the 560 turkeys examined, 336 (60%) of them were infected with *Ascaridia sp*. and no cestode infection was observed.

A research was conducted on turkeys which aims to study the abundance and prevalence of parasites of poultry, from three localities around Kedah, Malaysia. A total of 20 turkeys (eight males and twelve females) were examined for ectoparasites infestation and endoparasites infection**.** Endoparasite infection was recorded in two species of parasite eggs of nematodes and protozoa. Helminth parasites involving nematodes and protozoans were reported in faecal specimens of turkeys, comprised of *Capillaria spp*. and coccidian oocyst of *Eimeria spp.* Since no turkeys were slaughtered to observe the gastrointestinal infection for this internal parasite, faeces were collected to study the presence of parasite eggs. However, this faecal examination only discovered a low number of endoparasites species and coproculture method need to be done in order to identify the worms. Microscopic examination by using McMaster method, following floatation method to detect the presence of parasite eggs in turkey faeces only found these two types of endoparasites. Coccidian oocyst from protozoan,

Eimeria spp. recorded the highest reading of egg per gram with 7,300 epg compared to *Capillaria spp*. where only 1200 epg were found. As a matter of fact, Udoh *et al.* (2014) recorded the same endoparasites in domestic turkeys. In particular, various species of *Capillaria* in several poultry were recorded by Kaufmann *et al*. (2011), Abdul Wahab *et al.* (2009), Muhairwa *et al*. (2007), Rabbi *et al.* (2006), Permin *et al*. (1999) Castle and Christensen (1984) and Hon *et al.* (1975). For *Eimeria*, coccidian oocyst infection in certain bird species were reported found by Fiaz (2013), Puttalakshmama *et al.* (2008) and Permin *et al*. (2002). Permin and Hansen (1998) mentioned *Capillaria spp.* was found infecting the intestinal tract of domesticated and wild birds. Meanwhile *Eimeria spp.* Infection in birds can lead to coccidiosis, the most common disease caused by a protozoan that is becoming a problem for poultry globally (El-Shahawy, 2010). Moreover, *Eimeria spp.* that belongs to protozoan types of endoparasites are host specific with absence of intermediate hosts and have direct life cycle (Badran and Lukesova, 2006; Mcdougald, 1998). The environmental condition of coops that have restricted accessibility to vegetation stimulates the foraging behaviour of turkeys which increases the risk of helminth dissemination as infective stages occur in soil and faeces.

During 1970 and 1971, 113 wild turkeys (*Meleagris gallopavo*) ranging from 1 day to 9 months in age were collected on the Fisheating Creek Wildlife Management Area in southern Florida. In the summer of 1971, poults acquired helminths during their first week. The nematode, *Dispharynx nasuta*, was the first helminth to appear, with birds as young as 3 days infected. One-week-old poults collected in 1970 were free of helminths, indicating variation between years in the early acquisition of parasites. Rainfall and creek levels, which affected the feeding range of turkey broods and inhabitable range of intermediate hosts, appeared to influence *Dispharynx* burdens. The nine most common helminths had five patterns of seasonal occurrence: peaks in summer (*Dispharynx nasuta* and *Cyrnea colini*), peaks in both summer and winter (*Ascaridia dissimilis*), peaks in winter (*Zygocotyle lunata* and *Trichostrongylus tennis*), persistently high intensity (*Metroliasthes lucida*, *Strongyloides sp*., and *Capillaria sp*.), and irregular fluctuations (*Echinoparyphium recurvatum*).

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CHAPTER 3

MATERIALS AND METHODS

3.1. Sampling area

The intestines of the slaughtered turkey were collected from two different market areas of Dhaka city, Mohammadpur Town Hall Kacha Bazar and Agargaon Bazar, and from another reputed private university, named Gonobissobiddaloi, savar, Dhaka. The study population comprised domestic turkeys slaughtered in slaughter slabs in market. The gastrointestinal tracts were collected in clean sample bottles and brought to the laboratory of Microbiology and Parasitology, Faculty of Animal Science and Veterinary Medicine, Sher-e- Bangla Agricultural University, Dhaka.

3.2. Processing of sample

The samples were used for the isolation of helminths. The gastrointestinal tracts were then separated into small intestine, caecum and large intestine. The entire length of each part of the intestine was incised longitudinally, and the contents were emptied into sieves placed in large clean plastic cups with labelling. Then scrapping was done gently under the running tap water. The collected helminths were washed with normal saline. Small helminths were examined under a light microscope. Worms were grouped and counted before being stored in plastic bottles containing 70% alcohol according to the method described by Permin and Hansen (1999).

3.3. Identification of helminths

In case of nematodes, the specimens were not stained but cleared, and examined for identification. For this purpose, the collected heminths were examined under microscope using lactophenol, and the photographs were taken from different body parts as an aid for identification. Nematodes were identified by morphological characters according to the description of Soulsby (Soulsby, 1982).

CHAPTER 4

RESULTS AND DISCUSSION

4.1. Results

Through the examination of 50 samples, two helminths (*Heterakis gallinarum* and *Capillaria philippinensis)* were confirmed by observing the morphological properties under light microscope.

4 .1.1. Morphological observations:

4 .1.2. Classification and description of detected endoparasites:

4.1.2.1. Classification:

Kingdom: Animalia

Phylum: Nematoda

Class: Secementea

Order: Ascaridida

Family: *Ascarididae*

Genus: *Heterakis*

Species: *H. gallinarum* (Schrank, 1788)

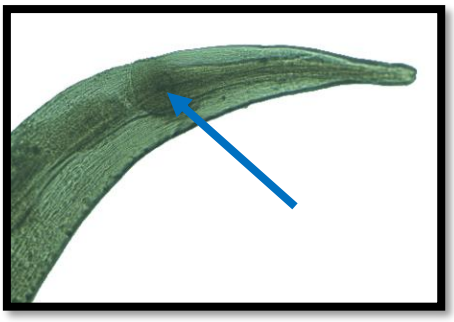
4.1.2.2. Description

4.1.2.3. *Heterakis gallinarum*

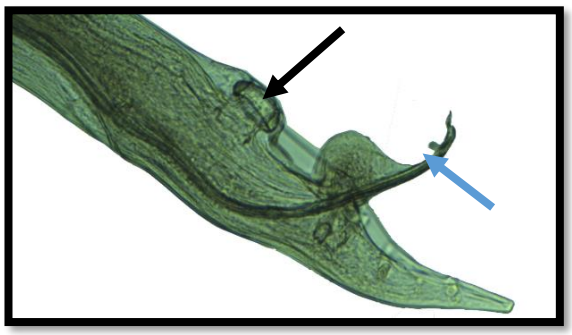
All adult worms were recovered from large intestine. The worms were small and white in colour and had three well-defined lips (Figure 2A), which are the general characters of the Order Ascaridida. The head end of the worms were slightly curved. The esophagus was engaged with a short narrow anterior portion, pharynx, and ended in a well-developed bulb containing a valvular apparatus. These are the common features of the family Heterakidae. The cuticle was usually with lateral flanges. Alae, ran almost the entire length of the body, were ridges formed by the thickening of the cuticle (Figure 2G). Adult female and male caecal worms differed in length, with the female generally

being larger than that of the male. The tail end of female was elongated and gradually tapered (Figure 2E). The anal opening was at the posterior part of body. The vulva of the female was located at the middle of the body (Figure 2F). There were three bends in the vagina after the vulva, angled posteriorly, anteriorly and once again posteriorly. Male worms had stylet-like tail end that smoothly taper. The worms had two well-developed unequal spicules at the posterior end (Figure 2C). Gubernaculum is absent. The preanal sucker was easily seen which was round, well-developed and surrounded by a chitinized ring. Eggs in the uterus were ellipsoidal with a thick, smooth shell, containing a single cell (Figure 2D). Each of the morphological characteristics are almost identical to the Genus *Heterakis,* and Species *H. gallinarum.*

A



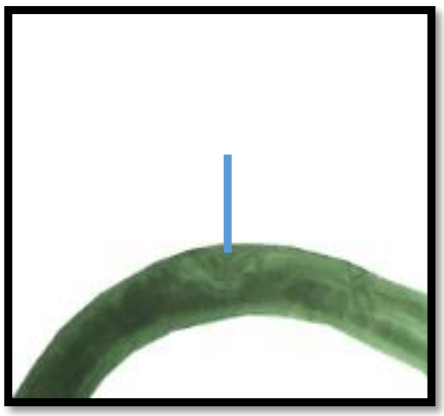
B



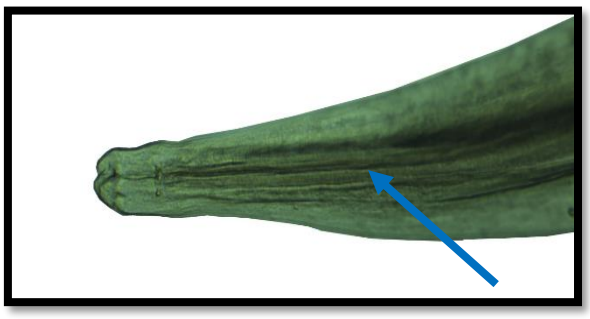
C

D

E



F



G

Figure 1: Different body parts of *H. gallinarum*, **A**. Anterior part of the parasite; the blue arrow indicates three well-defined lips (10X) **B.** Blue arrow indicates bulb shaped esophagus (10X). **C.** Posterior part of the male; the black arrow shows the pre-cloacal sucker and the blue arrow shows the spicule (10X). **D.** Multiple eggs in the uterus of female. **E.** Posterior part of female (10X). **F.** Blue line indicates vulvar opening of the female. **G.** Blue arrow indicates the alae, which ran almost the entire length of the body (10X).

4.1.2.4. Classification:

Kingdom: Animalia

Phylum: Nematoda

Class: Enoplea

Order: Enoplida

Family: Capillariidae

Genus: *Capillaria*

Species: *C. philippinensis* (Velasquez, Chitwood and Salazar, 1968)

4.1.2.5. Description

4.1.2.6. *Capillaria philippinensis*

All adult worms were recovered from small intestine. *Capillaria philippinensis* are long and slender, extremely thin, filamentous. The males usually slightly shorter than the females. The eggs are oval with characteristic bipolar plugs, which are the general characters of the Order Enoplida. The unembryonated eggs of *C. philippinensis* are peanut shaped (Figure 3C). Body is divided into anterior body which contains esophagus and esophageal gland, and posterior body containing intestine and reproductive system (Figure 3B).Vulva of the female worm immediately behind the esophagus (Figure 3B). These are the common features of the family Capillariidae. Male have a single spicule whose Sheath is very long without spine (Figure 3D). Anterior part is pointed (Figure 3A). Posterior end has bluntly conical structure which is more wider than anterior part (Figure 3E). Each of the morphological characteristics are almost identical to the Genus *Capillaria* and Species *C. philippinensis*

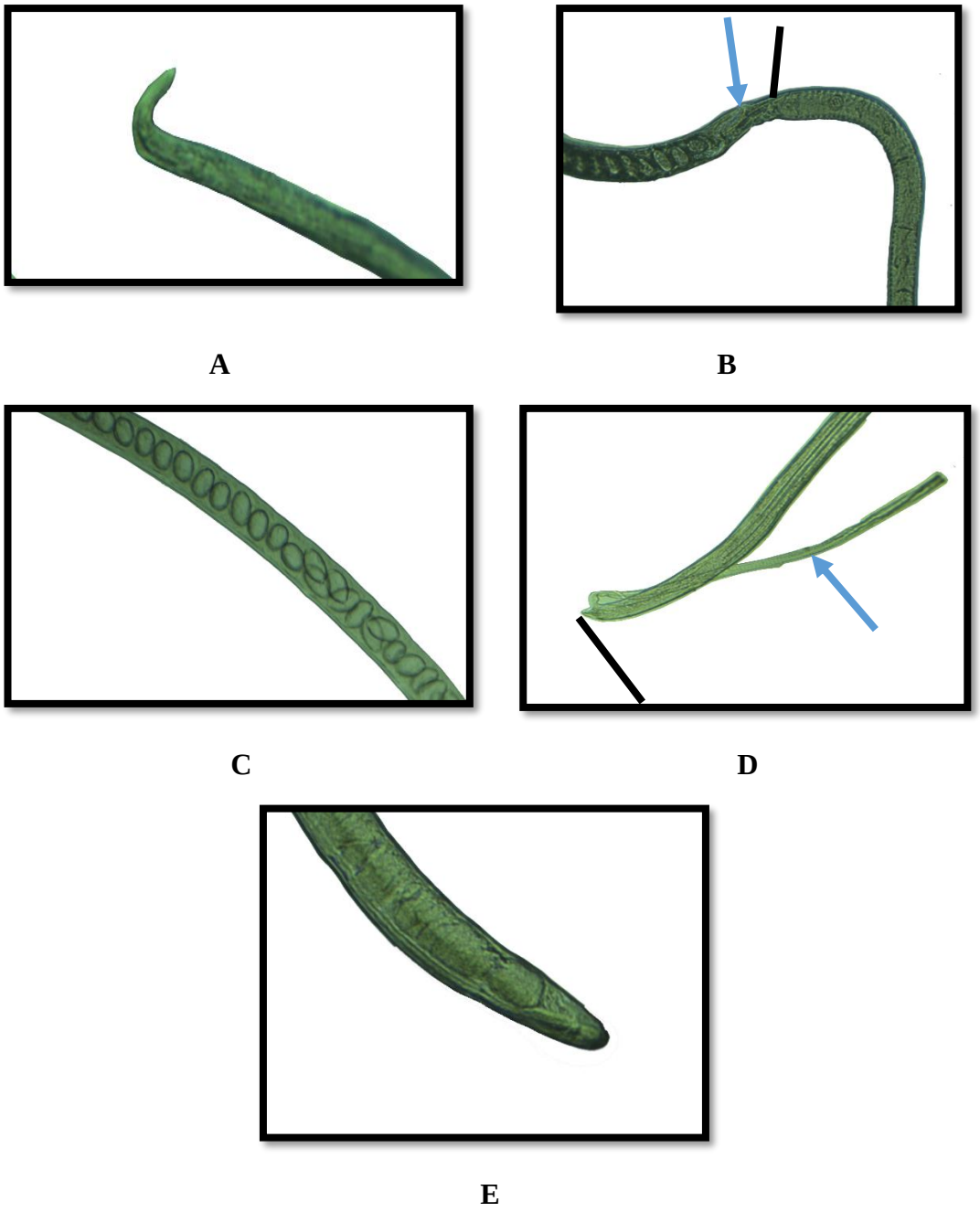


Figure 2: Different body parts of *C. philippinensis*, **A**. Anterior part of *C. philippinensis* (10X). **B.** Blue arrow indicates the vulva of female worm and black line indicates esophagus of *C. philippinensis*. **C.** Multiple eggs in the uterus of female (10X). **D.** Posterior part of male (10X); blue arrow indicates long sheath & black line indicates chitinous spicule. **E.** Posterior part of female (10X).

4.1.3. Prevalance

The study was carried out in a total of 50 gastrointestinal tracts of turkey. Out of the 50 examined samples, 37 (74%) were infected with two species of gastrointestinal helminths and 13 (26%) were non-infected (Fig 3). Both of the helminths were belongs to gastrointestinal tracts of turkey, namely *H. gallinarum* (62%) in large intestine and *C. philippinensis* (74%) in small intestine (Table 1).

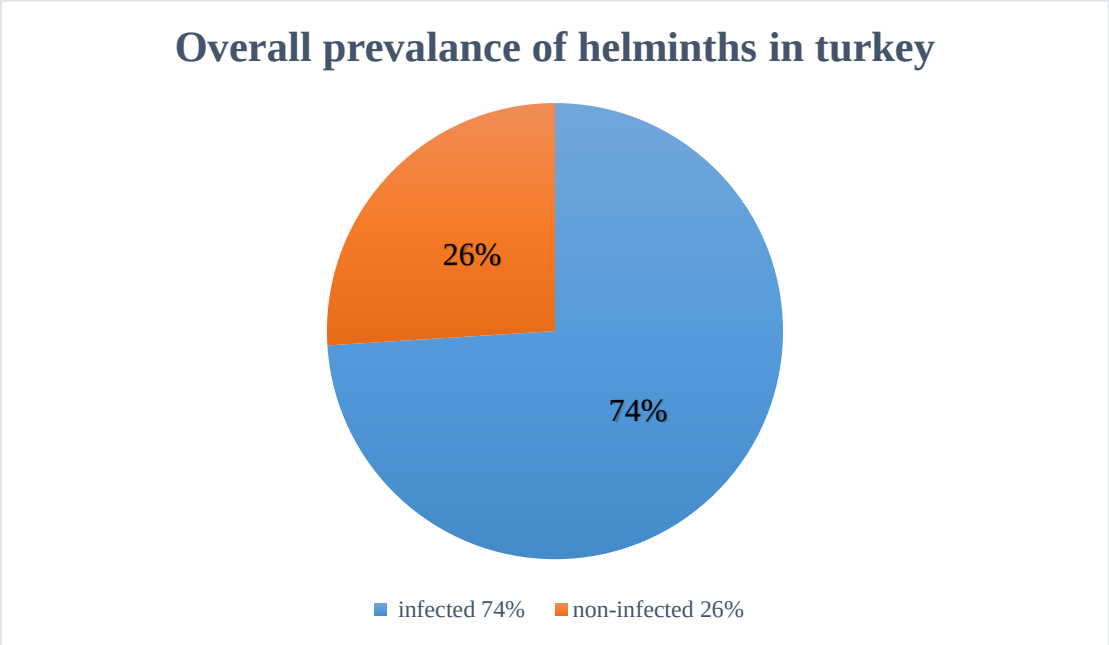


Fig 3: Overall prevalence of helminths in turkey

Table 1: Species wise prevalence of helminths in turkey

Helminths	No. of infected turkey	Location	Prevalance
H. gallinarum	31	Large intestine	62%
C. philippinensis	37	Small intestine	74%

The samples were collected from Gonosbissobiddaloi (n=30), Mohammadpur Town Hall Kacha Bazar (n=15) and from Agargaon Bazar (n=5).

Table 2: Prevalence of helminths from different area in Dhaka city

Sources of sample	No. of Infected sample	Prevalance of sample	Helminths	Prevalance Of helminths
Gonobissobiddaloi (n=30)	23	76.66%	*H. gallinarum* (17)	56.66%
			C. philippinensis (23)	76.66%
Mohammadpur Town Hall Kacha Bazar (n=15)	11	73.33%	*H. gallinarum* (11)	73.33%
			C. philippinensis (11)	73.33%
Agargaon Bazar (n=5)	3	60%	*H. gallinarum* (3)	60%
			C. philippinensis (3)	60%

The highest prevalence of *H. gallinarum* (73.33%) was in Mohammadpur Town Hall Kacha Bazar followed by Agargaon Bazar (60%) and Gonobissobiddaloi (56.66%). The sample size was low in Agargaon Bazar (5) than Mohammadpur Town Hall Kacha

Bazar (15) and Gonobissobiddaloi (30). *Capillaria philippinensis* was high in Gonobissobiddaloi (76.66%) and low in Agargaon Bazar (60%) (Table 2).

Table 3: Prevalance of single and multiple type of infection

Type of infection	No. infected Turkey	Prevalance
Single species	17	45.94%
Mixed species	20	54.1%

Examined gastrointestinal tracts of turkeys were infected by two species of helminth parasites. Among the 50 turkey, 17 were infected with single species of helminths (45.94%) and rest 20 were infected with mixed species of helminths (54.1%) (Table 3).

4.2. Discussion

To the best of our knowledge, this is the first report on gastrointestinal helminths of domestic turkeys in Dhaka city. The samples were collected from two different market areas (Mohammadpur Town Hall Kacha Bazar, Agargaon Bazar) of Dhaka city and also from a private university named Gonobissobiddaloi. These turkeys are brought to Dhaka from different areas of Bangladesh (Mymensingh, Gazipur, Savar, Rajshahi, Faridpur, Gaibandha, Rangpur etc.) where turkey farms are available. Therefore, the samples represent the turkey from all areas of the country. The present study revealed that the turkeys are highly infected (74%) with gastrointestinal helminths. After the extensive study of the gastrointestinal tracts of turkey (*Meleagridis gallopavo*) for helminth parasitism in different market areas in Dhaka, Bangladesh, two types of nematode, *H. gallinarum* (62%) and *C. philippinensis* (74%) (Table 1), were recovered with high prevalence. The helminths were collected from large and small intestine and identified on the basis of their morphological characteristics.

Simillar studies were conducted by earlier scientists in different parts of the world. (Daryoush, 2014) reported 75% infection with nematode in Amol city, Iran. Out of 60 native turkey 75% of samples were infected with nematodes, cestodes and trematodes. The result is quite similar to that of our study because of the number of sample and the study was based on a non-random sample of indeginous turkey's viscera. The prevalence of the recovered helminths was 20% *Capillaria,* 51% *A. gali*, 8% *R. tetragona,* 8% *R. echinobothrida* and 11% *Echinostoma.* The results indicated that nematode had the highest prevalence among helminth parasites of turkeys in Amol and north of Iran. Present study indicates 62% *H. gallinarum* infection in turkeys of Bangladesh. However, (Udoh *et al*., 2014) reported 1% *Heterakis* infection in Kaduna State, Nigeria. El-Dakhly *et al*. (2016) reported 0.41% *Heterakis* in Beni-Suef province, Egypt. This can be for foraging habit of turkey, management system and poor sanitary system. Turkeys are opportunistically omnivorous, trends on a wide range of food, both animal and vegetable origin. Earthworms can serve as paratenic hosts for juveniles, allowing them to move from the soil to a bird's gut. *Heterakis gallinarum* eggs can remain infective in soil for four years, a high risk of transmitting blackhead disease to turkeys remains if they graze areas with feces. Birds can ingest infected *H. gallinarum*

eggs and acquire *H. meleagridis*, resulting in blackhead disease. Blackhead disease affects mainly the liver and cecum of infected birds, causing lesions and ulcers that are eventually fatal (Olsen, 1986; Kaufmann, 1996). The highest infection of *H. gallinarum* was found in Mohammadpur Town Hall Kacha Bazar (73.33%) followed by Agargaon Bazar (60%), Gonobissobiddaloi (56.66%) (Table 2). The sample size was low in Bnp Bazar (5) than Mohammadpur Town Hall Kacha Bazar (15) and Gonobissobiddaloi (30), it is very difficult to interpret the variation. *Heterakis gallinarum* was found in the large intestine (62%).

Pinto *et al.* (2004) reported 82.5% *Capillarid* worm in turkey from Brazil. Udoh *et al.* (2014) reported 0.5% *Capillaria* in Kaduna State, Nigeria. (Daryoush, 2014) reported 20% *capillaria* worm infection in turkey of Amol and north of Iran. El-Dakhly *et al.* (2016) reported 0.27% *Capillaria spp* in Egypt. In our present study, the prevalance of *C. philippinensis* is 74%. This could be due to the fact of climate and environmental fluctuation in the area which favour the growth of the parasites.

Capillariasis is a parasitic disease in humans caused *C. philippinensis.* Many species of freshwater fish appear susceptible to infection and act as an intermediate hosts. Intestinal capillariasis appeared first in the Philippines and subsequently in Thailand, Japan, Iran, Egypt and Taiwan; major outbreaks have occurred in the Philippines and Thailand. *Capillaria philippinensis* prefer small intestine for their habitat and the infection rate is (74%) (Table 1).

Nematodes had the highest prevalence as compared to cestodes, with *ascaris* having a prevalence of 26.0%. This work agrees with earlier findings of Yoriyo *et al*. (2008); Ohaeri and Okwum, (2013) which indicates that nematode parasites are always more prevalent than the cestodes. There was no *ascaridia* worm in this study. This could be due to the environmental condition which was resistant to infective eggs of *ascaridia* at that time. A feature of this study was the complete absence of trematode and cestode in the gastrointestinal tracts of the domestic turkeys. This could be due to the complex life cycle of worms or may be due to the feeding patterns of the birds, incidence of the infective stages and intermediate hosts of the parasites picked up by the birds. The nematodes do not require intermediate hosts as the cestodes do and are mostly soil

transmitted, their eggs can remain viable for a long time enabling the turkeys to constantly pick up the viable eggs from the droppings that contaminate the environment as they feed and increase parasite burden (Permin and Hansen, 1998; Ohaeri and Okwum, 2013).

The prevalence of helminths infections in farming turkey is more than that of wet markets turkey. It may be influenced by several factors such as distribution of intermediate hosts and their infection rate and the number of infective parasite eggs or larvae. Poor sanitary condition and lack of proper hygiene is a major contributing factor to the high prevalence recorded in this study. Most backyard farmers do not bother about keeping their gutters and surrounding clean, which exposes the birds to serious infection.

Mixed infections of two or more species of parasites per turkey were common in this study, and higher prevalence of mixed infections was recorded 54.1% as compared to the single infection 45.94% (Table 3). This outcome might be attributed to the food preference at a particular time which to a great extent can determine the establishment of mixed or single infection. The ability of one or more parasites to survive within the same host has increased the prevalence of mixed infection but as the number of parasites per host increases, the prevalence decreases due to the inability of the parasites to tolerate one another. (Reid, 1962; Smyth, 1976; Fatihu *et al*. 1991).

CHAPTER 5

SUMMARY AND CONCLUSION

This study revealed the presence of nematodes in turkeys which were slaughtered in different market areas (Mohammadpur Town Hall Kacha Bazar, Agargaon Bazar) of Dhaka city and also from a private university named Gonobissobiddaloi. The prevalence rate of infected turkey was high (74%). This study was done to find out the prevalence of gastrointestinal helminths of turkey (*Meleagris gallopavo*). 50 intestines of turkeys were subjected to study, and the overall result showed that 74% turkeys were infected with gastrointestinal helminths. The result showed that, Only nematodes were found and the overall incidence of endoparasites in turkey for *H. gallinarum* and *C. philippinensis*, 62% and 74% respectively. The smaller size of the sample and non-randomness is responsible for the higher prevalence of gastrointestinal helminths. Gastrointestinal helminth may cause chronic illness through malnutrition including vitamin deficiencies, stunted growth, anemia, and protein-energy malnutrition. *Heterakis gallinarum* eggs can remain infective in soil and high risk of transmitting blackhead disease to turkeys. *Capillariasis* is considered a zoonotic disease which is caused by *C. philippinensis*. Eggs passes with the feces, reach water, embryonate, and infect fish. Autoinfection is part of the life cycle and leads to hyperinfection. Humans acquire the infection by eating raw freshwater fish. Turkey has become more popular bird in Bangladesh for its delicious meat with low fat. Therefore, proper attention should be needed and further large-scale studies are needed to discover the impact of zoonotic helminth infection in Bangladesh.

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