Chapter-I

Introduction

There are approximately 20 billion poultry in the world, with approximately 75 percent of them in developing countries (Gebremariam et al., 2011). Today, the poultry subsector plays an important role in Bangladesh's national economic growth and job creation (Hamid et al., 2017). According to the United States Department of Agriculture (USDA), about 1 million entrepreneurs and 8 million are directly or indirectly involved in this sector. Over the past few decades, the poultry industry has been Bangladesh's fastest growing livestock subsector with an annual growth rate of 20% (Islam et al., 2014). Poultry farming in Bangladesh began in the 1980s with backyard poultry farming (Begum, 2005). However, major progress was made in the 1990s, when many private farms invested in the industry and began producing day-old chicks (DLS, 2016). This sector plays a major role in Bangladesh's food sector, accounting for 37% of the total meat supply and reportedly covering 22-27% of the total human protein requirements (Hamid et al., 2017). According to DLS (2021), of Bangladesh's 365.85 million poultry populations, there are 341.11 million chickens and 61.75 million ducks.

Despite the rapid growth of Bangladesh's poultry industry, several factors have reduced growth rates and caused chicken mortality (Badruzzaman et al., 2015). Among these factors, poultry disease is one of the main constraints that impede the productivity and economic improvement of poultry farmers (Islam et al., 2016). It is noted that around 30% of all chickens in Bangladesh die from multiple disease outbreaks (Badruzzaman et al., 2015). Poultry diseases spread due to a variety of factors including climate, geographic location, farm hygiene, biosecurity, immune status, chick quality, hatcheries, and management practices (Abbas et al., 2015; Badruzzaman et al., 2015; Chakma, 2015; Hassan et al., 2016). In addition to the type of chicken, type of production, age and gender play important roles in the spread of the disease (Yunus et al., 2009; Rashid et al., 2013; Talukder et al., 2017; Rahman et al., 2019).

Coccidiosis is one of the most common and economically important diseases in the poultry industry around the world. It is caused by an intracellular protozoan parasite of the genus *Eimeria,* commonly called coccidia, which has a complex life cycle. Commercial broiler coccidiosis is often considered ubiquitous (Stayer et al., 1995; McDougald, 2003). Coccidiosis is one of the most

serious poultry diseases that infect the lining of the intestines. Damaged tissue caused by coccidia leads to reduced feed intake, impaired normal digestion and nutrition, dehydration and blood loss (Pangasa et al., 2007). Chickens suffering from coccidiosis quickly become less productive and perform poorly. Laying hens experience a decrease in egg production (Nematollahi et al., 2009).

Chickens are affected by coccidiosis in both clinical and subclinical forms (Sandhu et al., 2009). The disease is classified into two types based on how it affects organs: intestinal coccidiosis, which affects the small intestine, and caecal coccidiosis, which affects the large intestine (Caeca). Coccidiosis is characterized by dysentery, enteritis, diarrhoea, bloody in certain *Eimeria* species, weakness, reduced feed conversion ratio, delayed sexual maturation, drooping of wings, poor growth, decreased production (Rehman et al., 2010; Awais et al., 2012), associated with increase mortality and morbidity (Shirzad et al., 2011). Factors contributing to the development of clinical coccidiosis include more than 30% litter moisture, immunosuppression, suboptimal intake of anticoccidiosis in the diet, and the environmental and management stress such as inadequate ventilation, overstocking and inadequate feeding system (Baba et al., 1982; Singla et al., 2007). Subclinical coccidiosis is characterized primarily by poor weight gain and decreased feed conversion efficiency, leading to significant economic losses (Razmi and Kalideri, 2000). The loss of coccidiosis, excluding subclinical coccidiosis, is estimated at US $ 2 billion worldwide.

Coccidiosis only occurs after ingesting sporulated oocysts in a susceptible host. Both clinically infected and recovered birds excrete oocysts in their feces, which contaminate feed, dust, water, litter and soil. Oocysts can be transmitted through mechanical means such as equipment, clothing, insects, farm workers, other animals etc. (Hadipour et al., 2011). A moist litter with a high water content and a heat of 25-30 °C promotes oocyst sporulation (David, 2000). A sudden onset of coccidiosis occurred after ingestion of high-doses sporulated oocysts by non-immune young (3-8 week old) birds (Davis, 1981; Unquhart et al., 1996; David, 2000). Birds of all ages are susceptible to coccidiosis, but most birds become infected in the first few weeks of life (Chookyinox et al., 2009). Mortality is usually higher in young chicks because most *Eimeria* species parasitize birds aged 3-18 weeks (Nematollahi et al., 2009; Dakpogan et al., 2013).

Coccidiosis is common in all parts of the world with poorly managed cage rearing (Donal and McKenzie, 2007). In Bangladesh, a preliminary report on the occurrence of *E. tenella, E. necatrix* and *E. maxima* was confirmed by the faeces examination of chicks at the poultry farm of the

Bangladesh Agricultural University (Mondal and Qadir, 1978). In other previous studies, seven species of *Eimeria* have been reported in native chickens of Bangladesh (Karim and Begum, 1994, Siddiki et al., 2014).

Chapter-II

Materials and Methods

2.1 Case report

The case was handled in Upazila Livestock Office and Veterinary Hospital (ULOVH), Chakaria, Cox's Bazar. On 15th February, 2021 two dead and one live 20-day-old broiler chicken from a flock of 1000 birds reared on deep litter were brought to the Upazila Livestock Office and Veterinary Hospital, Chakaria, Cox's Bazar for clinical evaluation. The main complaint was the sudden onset of high mortality two days before presentation. A total of 40 birds have been lost. The clinical symptoms observed were disordered feathers, blood stained whitish to brownish diarrhoea, loss of appetite, and depression. Visits to the farm revealed inadequate hygiene and ventilation standards. After 3-5 days of dosing Renamox (amoxicillin) and ESB_3 (sulfaclozine Na) in water, the mortality rate ended**.** After recovery vitamin AD_3 was recommended.

2.2 Examination procedure

In ULOVH, Chakaria, Cox's Bazar there was a designated area where the clinical examination and post-mortem (PM) examination of sick and dead birds were carried out. The PM examination was performed based on the standard procedure and protocol described in the Atlas of Avian Necropsy (Majó and Dolz, 2011). During the post-mortem examination personal protection was ensured to prevent contamination. The birds were systematically examined and gross pathological lesions were observed and carefully recorded. As the laboratory facilities were not up to the mark, the final diagnosis of all bacterial, viral, and fungal diseases was made based on clinical history, clinical symptoms, and post-mortem lesions, as mentioned in the Manual of Poultry Diseases (Brugere-Picoux et al., 2015). After the post-mortem examination, the dead birds were immediately thrown into the garbage dump.

2.3 Gross lesions

During the post-mortem examination of the dead birds, the following gross lesions were observed: distended caecal and intestinal segments with frank blood, mucus and tissue debris. There was found hemorrhages in the caecal wall and clotted blood in the lumen of caeca. There was sloughing of the intestinal mucosa and mucosa was lined by a pseudomembrane. There was also found hemorrhages in the intestine.

Figure 1: Hemorrhage in intestine

Figure 2: Clotted blood in intestine

Figure 3: Pseudomembrane in intestine

Figure 4: Distended caeca with clotted blood in the lumen of the caecum

2.4 Microscopic findings

The main features of the members of the *Eimeria* are: The structure of the sporulated oocyst, which always contains four sporocysts, each contains two sporozoites. In coproscopy, sporulated oocyst of *Eimeria* was found.

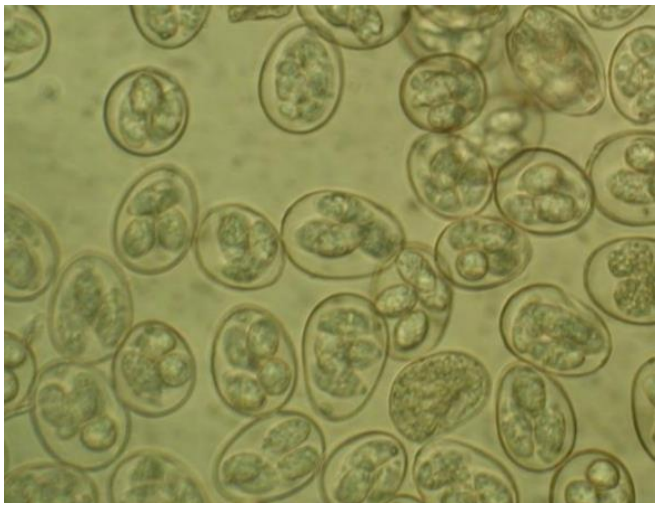

Figure 5: Sporulated oocyst of *Eimeria* Species

2.5 Diagnosis

Based on clinical history, clinical signs, gross lesions and microscopic findings the disease was diagnosed as coccidiosis (caecal and intestinal) and necrotic enteritis.

Chapter-III

Results and Discussion

Under field situations, a preliminary diagnosis of coccidiosis can be made based on clinical history, clinical symptoms, post-mortem examination and a minimal parasitological examination (Adene and Oluleye, 2004). The segmental locations and the type of intestinal lesions strongly indicate the species involved in the outbreak. For example, *E. tenella* parasitizes the caecum, while *E. necatrix* is responsible for the middle intestinal lesions associated with sloughing of the intestinal mucosa (Bishu, 1982; David, 2000; Adene and Oluleye, 2004), as observed in this case. Treatment can therefore be initiated while laboratory testing confirms the diagnosis (Adene and Oluleye, 2004).

The possibility of intercurrent bacterial infections has been reported (Adene and Oluleye, 2004), as in this case where *Clostridium perfringens* causes Necrotic Enteritis (NE). The main pathogenesis behind each *Eimeria* species is due to rapid proliferation within the mucosal epithelia of the intestinal lining, causing inflammation, disruption of intestinal integrity, and bleeding that lead to secondary infections, morbidity, and mortality (Assis et al., 2010). The intestinal damage caused by coccidia is a major predisposing factor for Necrotic Enteritis leading to *C. perfringens* overgrowth and toxin production (Assis et al., 2010). Therefore, treatment for secondary bacterial infections should often be considered in coccidiosis outbreaks. Here, as a treatment, we have given amoxicillin and sulfaclozine Na. After recovery vitamin AD_3 was recommended for epithelial regeneration of intestine. Other supportive treatment like immune stimulator can also be provided.

It has been reported that a high stocking density promotes coccidiosis (Trees, 1999; David, 2000; Etuk et al., 2004). Alternatively, contaminated equipment, food containers, staff, rodents, insects and wild birds have been blamed for the spread of coccidiosis (Abdu et al., 2008; Chookyinox et al., 2009). In addition, clinically infected and recovered adult birds have been shown to secrete oocysts in their feces, thereby contaminating food, dust, water and soil (Trees, 1999; David, 2000; Etuk et al., 2004). In addition, oocysts have been shown to survive outside the host for up to 2 years and withstand low temperatures, dry conditions and many forms of disinfectant (David, 2000). In this case *Clostridium perfringens* infection causing NE along with coccidiosis may strongly indicate poor sanitary and hygienic measures on the farm.

Chapter-IV

Conclusions and Recommendations

Coccidiosis is a major disease threat to commercial broiler production in Bangladesh. Appropriate measures must therefore be taken to prevent outbreaks of coccidiosis, otherwise they will continue to cause significant losses to the poultry industry, especially if conditions conducive to parasite development are created. Poor management, including wet litter and crowding, along with environmental and seasonal exposure add to the vulnerability of the vulnerable commercial poultry population, leading to the development and spread of coccidial infections.

A sanitary condition should be maintained on farms, including frequent removal of litter, clean feeding and water utensils. Since old chickens can serve as a source of infection (carrier) for young chickens, a mixed keeping of different age groups of chickens should be avoided. Avoiding overcrowding and making good use of a prophylactic anti-coccidial shuttle program are essential for controlling the threat of coccidiosis. Finally, more studies need to be carried out to develop sustainable and inexpensive prevention and control methods.

References

Abbas G, Khan SH, Hassan M, Mahmood S, Naz S and Gilani SS (2015). Incidence of poultry diseases in different seasons in Khushab district, Pakistan. Journal of Advance Veterinary and Animal Research 2(2):141-145.

Abdu PA, Wakawa AM, Ibrahim NDG and Sanusi A (2008). Veterinary Clinical Practice Bulletin. A J. Vet. Teaching Hospital, Ahmadu Bello University, Zaria, Nigeria, 1: 7-13.

Adene DF and Oluleye OB (2004). Coccidiosis of Poultry: The Biology Diagnosis, Treatment and Control. In: Adene DF. Poultry Health and Production Principles and Practices. Stirling-Horden Publishers (Nig.) Ltd. Ibadan, Nigeria, pp: 129-164.

Assis RCL, Luns FD, Beletti ME, Assis RL, Nasser NM, Faria ESM and Cury MC (2010). Histomorphometry and macroscopic intestinal lesions in broilers infected with *Eimeria acervulina*. Vet. Parasitol. 168:185–189.

Awais MM, Akhtar M, Iqbal Z, Muhammad F and Anwar MI (2012). Seasonal prevalence of coccidiosis in industrial broiler chickens in Faisalabad, Punjab, Pakistan. Tropical Animal Health and Production 44: 323-328.

Baba E, Fukata T and Arakawa A (1982). Establishment and persistence of *Salmonella typhimurium* infection stimulated by *Eimeria tenella* in chickens. Res. Vet. Sci. 33(1):95-98.

Badruzzaman ATM, Noor M, Mamun MAL, Husna A, Islam KM, Alam KJ and Rahman MM (2015). Prevalence of diseases in commercial chickens at Sylhet Division of Bangladesh. International Clinical Pathology Journal 1(5):104-108.

Begum IA (2005). An assessment of vertically integrated contract poultry farming: a case study in Bangladesh. International Journal of Poultry Sciences 4(3):167-176.

Bishu G (1982). Isolation and identification of two pathogenic *Eimeria* species in chickens in Nigeria. M.Sc. Thesis. Ahmadu Bello University, Zaria, Nigeria, pp: 52-61.

Brugere-Picoux J, Vaillancourt JP, Shivaprasad HL, Venne D and Bouzouaia M (2015). Manual of Poultry Diseases. France Association for the Advancement of Science, Paris, France.

Chakma S (2015). Epidemiology of infectious bursal disease in broiler birds of three districts in Bangladesh. Asian Journal of Medical and Biological Research 1(1):59-64.

Chookyinox L, Stella U and Sandy O (2009). Coccidiosis. Backyard Poultry Information Centre. PhpBB 2004-2009//backyard poultry.com.

Dakpogan HB and Salifou S (2013). Coccidiosis prevalence and intensity in litter based high stocking density layer rearing system of Benin. Journal of Animal and Plant Sciences 17: 2522- 2526.

David S (2000). Coccidiosis. Poultry Health and Management. Fourth Edition, ELST with Blackwell Publishers, pp: 105-107.

Davis PJ (1981). Immunity to Coccidiosis. In: Avian Immunology. Rose ME, Pyane LN and Freeman BM (Eds). Poultry Science Symposium No. 16.Clark Constable Ltd. Edingburg, pp: 361-380.

DLS (2016). Yearly updated report for 2015-2016. Government of the People's Republic of Bangladesh, Farmgate, Dhaka, Bangladesh. Available: https://www.dls.gov.bd

DLS (Department of livestock services) (2021). Annual report on livestock 2020-21. Division of Livestock Statistics, Ministry of Fisheries and Livestock, Farmgate, Dhaka, Bangladesh. Available: https://www.dls.gov.bd

Donal PC and McKenzie EM (2007). Poultry Coccidiosis, Diagnostic and Testing Proceduces. Blackwell Publishing; Iowa, USA. pp. 65-73.

Etuk EB, Okoli IC and Uko MU (2004). Prevalence and management issues associated with poultry coccidiosis in Abak agricultural zone of Akwalbom State, Nigeria. Int. J. Poult. Sci. 3: 135-139.

Gebremariam MK, Devarajan S and Ahmed B (2011). Prevalence of Helminth Parasites in Indigenous Fowls of ZobaAnseba of Eritrea, Northeast Africa. Vet. World J. 4(11):492-494.

Hadipour MM, Olyaie A, Naderi M, Azad F and Nekouie O (2011). Prevalence of *Eimeria* species in scavenging native chickens of Shiraz, Iran. African Journal of Microbiology Research 5(20):3296–3299.

Hamid MA, Rahman MA, Ahmed S and Hossain KM (2017). Status of poultry industry in Bangladesh and the role of private sector for its development. Asian Journal of Poultry Science 11(1):1-13.

Hassan MK, Kabir MH, Al Hasan MA, Sultana S, Khokon MSI and Kabir SL (2016). Prevalence of poultry diseases in Gazipur district of Bangladesh. Asian Journal of Medical and Biological Research 2(1):107-112.

Islam S, Islam A, Moni SP, Bari MS, Islam K, Chakma S, Hossain ME, Siddiqe MZF, Hoassain MB and Chowdhury S (2016). A cross sectional study of Infectious Bursal Disease and Newcastle Disease in poultry in Narsingdi district of Bangladesh. Journal of Advance Veterinary and Animal Research 3(4):406-412.

Islam SS, Islam S, Siddiqe ZF, Shawon RH, Hanif SM and Rahman MA (2014). Diseases of Birds and their responses to treatment in different regions of Bangladesh. International Journal Natural and Social Sciences 1(1):31-36.

Karim MJ and Begum N (1994). Morphological and biological characterization of chicken *Eimeria* with special reference to species identification. Veterinary Review, Pakhribas Agriculture Centre (PAC). 9 (1) and 10 (1): 7-9.

Majó N, Dolz R (2011). Atlas of Avian Necropsy, Servet Veterinary Publishing Company, Spain.

McDougald LR (2003). Protozoal infections. In : Saif YM , Barnes HJ, Glisson JR, Fadly AM , McDougald LR and Swayne DE, editors. Diseases of poultry. 11th edition. Iowa state University Press; 2003. pp: 973-1023.

Mondal MMH and Qadir ANMA (1978). A preliminary investigation on the incidence of coccidial infection in fowl, goat and cattle. Bangladesh Vetrinarian, 12: 7-11.

Nematollahi A, Moghaddam GH and Pourabad RF (2009). Prevalence of *Eimeria* species among broiler chicks in Tubriz (North West of Iran). Mun. Ent. Zool. 4(1):53-58.

Pangasa A, Singla LD, Sood N, Singh A and Juyal PD (2007) Histopathological evaluation of anticoccidial activity of an ayurvedic coccidiostat, in induced *Eimeria tenella* infection in chicken. Indian J. Anim. Sci. 77(3):214-216.

Rahman MA, Rahman MM, Abdullah MS, Sayeed MA, Rashid MH, Mahmud R, Belgrad JP and Hoque MA (2019). Epidemiological assessment of clinical poultry cases through the government veterinary hospital-based passive surveillance system in Bangladesh: a case study. Tropical Animal Health and Production 51(4):967-975.

Rashid MH, Xue C, Islam MT, Islam MR and Cao Y (2013). Risk factors associated with infectious bursal disease in commercial chickens in Bangladesh. Preventive Veterinary Medicine 111(1-2):181-185.

Razmi GR and Kalideri AG (2000). Prevalence of subclinical coccidiosis in broiler chicken farms in the municipality of Mashhad, Khorasan, Iran. Prev. Vet. Med. 44(3):3-4.

Rehman TU, Khan MN, Sajid MS, Abbas RZ, Arshad M, Iqbal Z and Iqbal A (2010). Epidemiology of *Eimeria* and associated risk factors in cattle of district Toba Tek Singh, Pakistan. Parasitology Research 108: 1171-1177.

Sandhu BS, Brar RS, Brar APS, Sood NK and Singla LD (2009). Prevalence and pathology of parasitic gastrointestinal infections of poultry in punjab. Indian Vet. J. 86:1276-77.

Shirzad MR, Seifi S, Gheisari HR, Hachesoo BA, Habibi H and Bujmehrani H (2011). Prevalence and risk factors for subclinical coccidiosis in broiler chicken farms in Mazandaran province, Iran. Tropical Animal Health and Production 43:1601-1604.

Siddiki AMAMZ, Mina SA, Hasan MA, Akbar MT, Alam R, Islam MA, Ira IZ and Ayesa BB (2014). Molecular characterization of *Eimeria* spp. from chicken by Polymerase Chain Reaction based on species-specific SCAR markers. IOSR Journal of Agriculture and Veterinary Science 7(1):13-17. https://doi.org/10.9790/2380-07111317

Singla LD, Pangasa A and Juyal PD (2007). Caecal coccidiosis: efficacy of ayurvedic and allopathic coccidiostats in immunomodulated broiler chicks. Proceedings of the 12th International Conference of the Association of Institutions of Tropical Veterinary Medicine held from August 19-22, 2007 at Montpellier, France. pp: 89-93.

Stayer PA, Pote LM and Keirs RW (1995). A comparison of *Eimeria* oocysts isolated from litter and fecal samples from broiler houses at two farms with different management schemes during one growout. Poultry Science 74: 26–32. https://doi.org/10.3382/ps.0740026

Trees AJ (1999). Parasitic diseases. In: F.T.W. Jordan and M. Pattison. Poultry Diseases, Fourth edition. W.B. Saunders Company, Ltd. 34: 261-289.

Talukder ML, Zuhra FT, Islam KE and Ahmed MS (2017). Prevalence of infectious diseases in Sonali chickens at Bogra Sadar Upazila, Bogra, Bangladesh. Journal of Advance Veterinary and Animal Research 4(1):39-44.

Unquhart GM, Armour J, Duncan JL, Dunn JN and FW Jennings (1996). Coccidiosis of Poultry. Blackwell Publishers, London, pp: 228-230.

Yunus AW, Nasir MK, Aziz T and Bohm J (2009). Prevalence of poultry diseases in district Chakwal and their interaction with mycotoxicosis: 2. Effects of season and feed. Journal of Animal and Plant Sciences 19(1):1-5.

Acknowledgement

Author is ever grateful and indebted to the Almighty without whose grace he would not have ever been able to complete the research work and this clinical report successfully.

The author wishes to owe his deep sense of gratitude and thanks to **Prof. Dr. Mohammad Alamgir Hossain**, Department of Pathology and Parasitology, Dean, Faculty of Veterinary Medicine, Chattogram Veterinary and Animal Sciences University for the skilful supervision to make this report with his knowledge, perceptiveness, inspiring scholastic guidance and encouragement.

The author would like to extend his thankfulness and respect to **Dr. Towhida Kamal**, Assistant Professor, Department of Pathology and Parasitology for giving guidelines and support to make this report.

The author again wishes to give special thanks to **Prof. Dr. Mohammad Alamgir Hossain**, Dean of FVM and **Prof. Dr. AKM Saifuddin**, Director, External Affairs for the provision of this unique internship program and research exposure.

The author would also like to express his sincere gratitude and thank to **Professor Dr. Gautam Budda Das**, honourable vice chancellor of Chattogram Veterinary and Animal Sciences University.

Finally, the author expresses his thanks to all of his family members, friends and well-wishers for their cordial helping hands.

The Author

Biography

I am Md. Ismail, son of Abu Nasar Md. Idris Kutubi and Zobaida Begum was born on 1st June, 1997. I have passed Secondary School Certificate examination from Chattogram Government Muslim High School, Chattogram in 2013 (GPA-5.00) followed by Higher Secondary Certificate examination from Hazera-Taju University College, Chattogram (GPA-5.00). I am now enrolled in year-long internship programme for completion of Doctor of Veterinary Medicine (DVM) degree in Chattogram Veterinary and Animal Sciences University (CVASU), Chattogram, Bangladesh.

Bangladesh is a developing country in South Asia where livestock plays a very important role in our economy as well as the food chain. I expect to be a future researcher of life science to address the present challenges we have in this field.