

INVESTIGATION OF DISEASES OF COMMERCIAL CHICKEN IN RANGPUR DISTRICT OF BANGLADESH

A THESIS

BY

S. M. TARIF-UZ-ZAMAN ANIK

REGISTRATION NO.: 1504064

SEMESTER: JULY-DECEMBER, 2023

SESSION: 2021-2022

MASTER OF SCIENCE

IN

MEDICINE



DEPARTMENT OF MEDICINE, SURGERY AND OBSTETRICS

**HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY
UNIVERSITY, DINAJPUR-5200**

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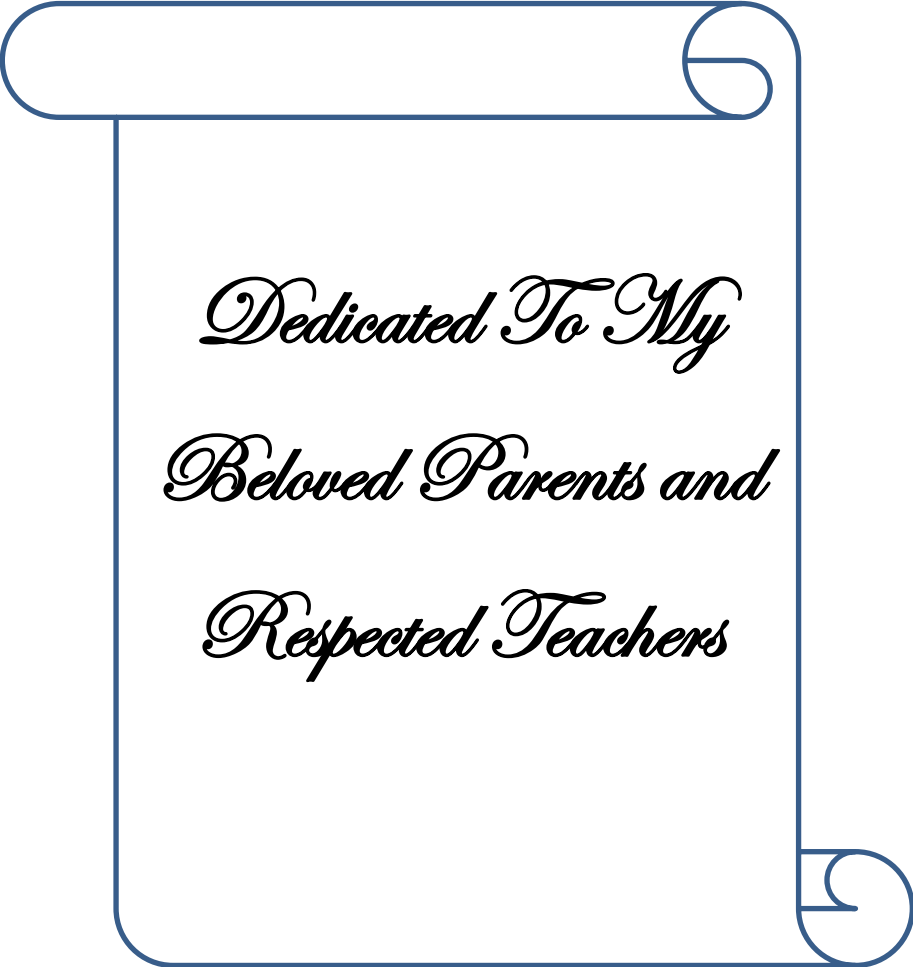
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*Dedicated To My
Beloved Parents and
Respected Teachers*

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ABSTRACT

This study was designed to investigate the diseases of commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh. The research was conducted for a period of six months from November 2022 to April 2023. A total of 870 clinically ill and dead chicken were taken from the study, of which 308 were broiler, 270 were sonali and 292 were layer chickens and the diagnosis was confirmed by postmortem examination of dead chicken. The overall prevalence of viral disease in broiler, sonali and layer chicken were 37.7%, 30.0% and 26.0% and bacterial disease were 20.1%, 15.6% and 42.8% and fungal, protozoan and other diseases were 42.2%, 54.4% and 31.2% respectively. Inclusion body hepatitis 57 (18.5%) in broiler, coccidiosis 88 (32.6%) in sonali chicken and colibacillosis 40 (13.7%) in layer chicken were predominant disease. Broiler chicken of 14-27 days old age group were more affected (63.2%) with inclusion body hepatitis; sonali chicken of 14-40 days' age were more (60.2%) affected with coccidiosis and layer chicken of more than 101 days age group showed highest prevalence (62.5%) of colibacillosis than other age group. Predominant diseases were more in flock size between 1001-1500, earthen floor type rearing system and in the farms reared by primary educated people. Treatment efficacy against inclusion body hepatitis in broiler, coccidiosis in sonali and colibacillosis in layer was best achieved by treating broiler with a combination of a) Glucose + Sodium-bicarbonate b) Liver tonic (Heparen/Neomeriol) c) Kidney tonic (Nephrocare/Lumix vet) d) Vitamin-C (Rena C/Vita C) (Ascorbic Acid-98%) e) Immunomodulator (Xillian/AIB Vet) and the sonali chicken with a) Diclazuril (dmeria) (2.0%) b) Vitamin-k (Rena K) c) Vitamin-C (Vita C) (Ascorbic Acid-98%) d) Kidney Tonic (Lumix vet) and layer chicken with a) Florfenicol b) Neomycin Sulphate (Neo vet 70) c) Kidney Tonic (Nephrocare) d) Toxin Binder (AquaTox) e) Vitamin E-Selenium (Sel E). It is concluded that different viral, bacterial and protozoan disease are circulating in broiler, sonali and layer chicken and still they are well managed by different commercial drugs in commercial chickens at farm levels.

LIST OF ABBREVIATIONS

ND	: Newcastle Disease
IB	: Infectious Bronchitis
IBD	: Infectious Bursal Disease
IBH	: Inclusion Body Hepatitis
NE	: Necrotic Entireties
CRD	: Chronic Respiratory Disease
%	: Percentage
&	: and
CM	: Centimeter
Ed	: Edition
et al	: and others
Kg	: Kilogram
MSO	: Medicine, Surgery and Obstetric
NVI	: National Veterinary Institute
PA	: Peasant Association
PM	: Post mortem
OIE	: World Organization for Animal Health
Wk	: Week
Yr	: Year
MG	: <i>Mycoplasma gallisepticum</i>

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CHAPTER I

INTRODUCTION

Poultry industry plays an important role in Bangladesh in fulfilling the protein demand of human (Islam *et al.*, 2014). Bangladesh is an agro-based country having poultry density of 1460 birds/sq. kilometer of which 50% is backyard poultry (Dolberg, 2008 and Biswas *et al.*, 2008) as people rear traditionally. South-East Asia is rapidly expanding its poultry production (Hellin *et al.*, 2015). Globally, the United States ranked first in contributing about 18% to poultry meat production (FAO, 2021). China was the leading poultry meat producer in Asia supplying 14.5 million tons of chicken meat annually. India produced 4.2 million tons of chicken meat annually. At present, Bangladesh produced 0.2 tons of poultry meat annually, inflating the sector over the past two decades to 22% of total animal protein consumed (FAOSTAT, 2021). Chickens in traditional village poultry systems provide scarce animal protein in the form of meat and eggs, and are available for sale or barter in societies where cash is not abundant. They are generally owned and managed by women and children (Gueye 2000; Spradbrow 1993-94). chicken production is increasing steadily in Bangladesh, from 261.47 million in 2014-15 to 311.8 million in 2021-22 (DLS, 2022). Broiler chickens are reared particularly for meat production because of their typical soft, tender meat, low-fat content, and short production period. Broilers take the place of valuable food animals globally by notably contributing to food security, protein supply, and people's employment (Kryger *et al.*, 2010). Broiler meat production has undergone exponential growth for global consumption and business profit. Low production costs and rapid economic progress are pivotal in its expansion (Najeeb *et al.*, 2014). Sonali chickens are well adapted in the environmental conditions of Bangladesh, as it requires less care and attention as compared to other breeds. It is also easier for women to rear (Saleque and Saha, 2013). The production records of this bird is better due to its higher disease resistance capability, minimum mortality, and fastest growth rate (more than 0.8kg by 60 days) (Howlader *et al.*, 2022). The poultry industry has a low barrier to entry (Shamsuddoha and Sohel, 2004) with one million entrepreneurs and eight million people involved (Anon, 2020).

There are many constraints to village chicken production (Sonaiya *et al.*, 1999) including a range of bacterial and other viral diseases, internal and external parasites (Permin and Hansen 1998), poor nutrition and predation. There is no common definition for backyard poultry flocks. Disease, faulty biosecurity, and inadequate nutrition challenge the growing industry (Wong *et al.*, 2017). Poor farm hygiene, bio-security, imperfect vaccine coverage, age, poultry strain, production type, flock size, floor type, farmers' education, and experiences are closely associated with common poultry diseases

(Meseret, 2016; Carrique-Mas *et al.*, 2019). Veterinary hospital-based passive surveillance rarely investigates disease prevalence and associated factors. About 30% mortality of chickens in Bangladesh in every year due to outbreaks of several diseases. Prevalence of infectious diseases is considered for establishing a commercial poultry farm. The northern part of Bangladesh is considered as a poultry hub especially of Sonali chicken, which is used as meat purpose. Biswas *et al.* (2006) reported that about 28% mortality of Sonali chickens in southeastern coast of Bangladesh due to outbreak of several infectious diseases.

Newcastle disease was the earliest economically important infectious disease for native and commercial poultry (Islam *et al.*, 1998) whereas infectious bursal disease was first reported in 1992 with high morbidity (Rahman *et al.*, 1996). They also reported that this disease was one of the serious threats to the mortality and reduce egg production and hatchability for up to 20.30%. Infectious bursal disease is an acute and highly contagious disease of young chicken which is caused by infectious bursal disease virus (IBDV). The causal agent was first isolated in Gumboro, and the disease was originally known as Gumboro disease (Quinn *et al.*, 2002). Infectious bronchitis (IB) is an acute, viral disease of poultry which has been implicated in severe economic losses mainly due to reduced performance and complication with secondary bacterial and viral coinfection that can result in high mortality (Cavanagh, 2007).

Avian pox is an infectious and contagious viral disease where infection occurs by mechanical transmission of the virus through the injured skin or through biting by mosquitoes and mites (Tripathy and Reed, 2003). It was noted that after feeding on an infected bird, mosquitoes can harbour and transmit the virus for a month or longer. Salmonellosis in poultry causes heavy economic loss through mortality and reduced production (Khan *et al.*, 1998). With great expansion of poultry rearing and farming, pullorum disease and fowl typhoid have become wide spread problem in Bangladesh (Sarker 1976, Rahman *et al.*, 1979). Age wise mortality of avian Salmonellosis showed highest infection rate in adult layers (53.25%) in comparison to brooding (14.55%), growing (16.10%) and pullet (16.10%) (Rahman *et al.*, 2004). Avian Pasteurellosis is a contagious bacterial infection. The disease can range from acute septicaemia (blood poisoning) to chronic and localised infections. *Pasteurella multocida*, a gram-negative bacterium, is the causative agent of fowl cholera in birds. Among avian strains of *P. multocida*, serogroup A strains cause the majority of fowl cholera. This organism being an opportunistic pathogen is also a common commensal in the upper respiratory tract of birds. The infection leads to acute septicaemia to chronic and localized infections and the morbidity and mortality might be up to 100 % as the pathogen resists phagocytosis after invading the internal tissues and multiply very quickly. The route of

infection is oral or nasal with transmission via nasal exudate, faeces, contaminated soil, equipment, and people. The incubation period is usually 5-8 days. Necrotic enteritis (NE) remains a major problem in the modern poultry industry, although in the past, it has been controlled by in-feed microbials, and ionophore anticoccidials (Cooper and Songer, 2010). Colibacillosis has become wide spread problem in Bangladesh like other areas of the world (Talha *et al.*, 2001; Islam *et al.*, 2003 and Rahman *et al.*, 2004). Heavy economic loss occurs in both broiler and layer due to morbidity, mortality, reduced production and chick quality. Mortality may rich up to 94% in severe outbreak of colibacillosis (McPeake *et al.*, 2005). Coccidiosis is the major parasitic disease of poultry with substantial economic losses due to malabsorption, bad feed conversion rate, reduced weight gain and increased mortality.

Developing countries often over-rely on antibiotics for disease treatment (Ur Rahman and Mohsin, 2019). Antibiotics are readily available over the counters without a prescription (Haque *et al.*, 2020) leading to indiscriminate use and antibiotic resistance (Oluwasile *et al.*, 2014). The Bangladesh poultry disease surveillance is poorly structured making antibiotic use patterns difficult to assess.

Therefore, the present study was focused out under the following objectives:

- ❖ To observed the prevalence of diseases of commercial chicken at mithapukur upazila in Rangpur district of Bangladesh
- ❖ To identify the risk factors associated with predominant diseases in commercial chicken.
- ❖ To observe the effectiveness of commercial drugs against different diseases of chicken.

CHAPTER II

REVIEW OF LITERATURE

2. 1 Overall prevalence of diseases in commercial chicken

Islam *et al.*, (2023) was performed in an attempt to investigate the prevalence of poultry diseases in the Barisal district of Bangladesh during the period from October 2018 to September 2019. A total of 863 poultry birds of different ages either dead or sick were examined for the study. History, owner's complaints, clinical signs, and post-mortem findings of dead and sacrificed birds were considered for the diagnosis of the diseases. The prevalence of diseases was recorded in layers (n=416) 48.20%, broilers (n=305) 35.34% and sonali chickens (n=142) 16.45%. Among the diseases, the overall prevalence of infectious bursal disease (IBD) was found highest (18.08%) followed by salmonellosis (15.41%), Newcastle disease (ND) (13.33%), Mycoplasmosis / chronic respiratory disease (CRD) (12.28%), colibacillosis (10.31%), coccidiosis (7.53%), infectious bronchitis (7.18%), aspergillosis (5.68%), omphalitis (2.55%), fowl cholera (2.43%), infectious Coryza (2.09%), fowl pox (1.51%), necrotic enteritis (1.16%), and Marek's disease (0.46%). Highest prevalence 17.79%, 27.87%, and 22.54% were recorded in salmonellosis, IBD, and ND respectively in layers, broilers, and sonali chickens. Based on seasonal variations, it was found that most of the diseases occurred in the summer (39.75%) followed by (32.33%) and (27.93%) respectively in winter and rainy season.

Belaly and Ramman (2022) designed to investigate prevalence and risk factors of Infectious Bursal Disease (IBD) in Sonali chicken in Joypurhat District of Bangladesh. Twenty-five sonali chicken farms with sum of 33,735 birds of various age groups from five different upazila were observed for Infectious Bursal Disease (IBD). The disease was diagnosed on the basis of history, clinical findings and postmortem lesions. The overall prevalence of IBD was 19.48% and mortality 5.85%. The highest prevalence 43.61% was significantly found ($P<0.05$) in Khetlal upazila and lowest 10.54% in kalai upazila. Chicken of 3 to 4 weeks age showed higher prevalence 21.68% than other age group. The prevalence was significantly higher in female 20.03% chicken than male 18.66%. Prevalence of IBD in sonali chicken was higher 46.15% in winter season and lowest 12.89% in rainy season. Vaccinated with AviPro® IB Ark (Elanco) significantly ($P<0.05$) reduces the prevalence and mortality rate

of IBD. Prevalence was low in fumigated concrete farm. Treatment with a) Levofloxacin (10%) b) Vitamin-C (Ascorbic Acid-98%) c) Ph (Formic acid, Lactic acid, Propionic acid & HMTBa) d) Molasses 5% e) Andopan significantly recovered the IBD infected chicken within 4 ± 0.75 days.

Howlader *et al.*, (2022) conducted a study to identify the socio-economic status and problems faced by the Sonali farmers at Wazirpur Upazila in Barishal District. This study revealed that a maximum portion of the farmers were middle-aged (52.2%), male (92.2%), and had a secondary level of education (54.4%). Most farmers had medium-sized farm (38.9%) and invested their own capital in farming (54.9%). Although major farmers had low experience in Sonali chicken farming, they had high management skills (63.9%). In terms of occupation, the highest percentage of farmers (38.9%) had a conjugated occupation of poultry and crop. Most of the farmers had their own tube-well (74.7%) and use sanitary latrine (71.1%). Nevertheless, only 17% of the farmers had good health condition. About 49% of the farmers had only one chicken house, and 87.8% followed the floor system for rearing Sonali chicken. Surprisingly, all the farms followed an all-in-all-out marketing system for Sonali chicken. Most of the farmers (96.7%) vaccinated their poultry birds and added coccidiostat (73.3%) and vitamin mineral premix (94.4%) to the feed. A major portion of the farmers identified the irregular fluctuation in the market price of feeds (95.6%) and day-old chicks (93.3%) as severe problem, followed by high price of feed but low price of meat (87.8%). A disorganized marketing channel was the next major problem faced by the poultry farmers (83.3%).

Gupta *et al.*, (2021) In order to control Highly Pathogenic Avian Influenza (HPAI) H5N1 and Low Pathogenic Avian Influenza (LPAI) H9N2 virus spread in endemically infected countries, a detailed understanding of infection patterns is required. We conducted cross-sectional studies in Bangladesh in 2016 and 2017, on 144 backyard, 106 broiler and 113 layer chicken farms. Although all sampled birds were negative for H5 virus by RT-PCR, H5 antibodies were detected in unvaccinated birds on all three farming systems. Higher H5 antibody prevalence was observed in ducks raised on backyard farms, 14.2% (95% CI: 10.0%–19.8%), compared to in-contact backyard chickens, 4.2% (95% CI: 2.8%–6.1%). The H5 antibody prevalence was lower in broiler chickens, 1.5% (95% CI: 0.9%–2.5%), compared to layer chickens, 7.8% (95% CI: 6.1%–9.8%). H9 viruses were detected by RT-PCR in 0.5% (95% CI: 0.2%–1.3%) and 0.6% (95% CI: 0.3%–1.5%) of broilers and layers, respectively, and in 0.2% (95% CI: 0.0%–1.2%) of backyard chickens. Backyard chickens

and ducks showed similar H9 antibody prevalence, 16.0% (95% CI: 13.2%–19.2%) and 15.7% (95% CI: 11.3%–21.4%), which was higher compared to layers, 5.8% (95% CI: 4.3%–7.6%), and broilers, 1.5% (95% CI: 0.9%–2.5%).

Rahman et al., (2021) A total of 88 farms with respiratory disease problems were identified and investigated during the surveillance. In addition, 22 small-scale commercial layer farms in the neighbouring areas with respiratory disease problem were also investigated on request from the farmers. Pooled samples of oropharyngeal swabs from live birds or respiratory tissues from dead birds of the farm suffering from respiratory disease problem were tested for molecular detection of avian influenza virus (AIV), Newcastle disease virus (NDV), infectious bronchitis virus (IBV), infectious laryngotracheitis virus (ILTV), *Mycoplasma gallisepticum* and *Avibacterium paragallinarum*. A total of 110 farms (88 in the surveillance site and 22 in the neighbouring region) were investigated, and one or more respiratory pathogens were detected from 89 farms. AIV was detected in 57 farms often concurrently with other pathogens. Among these 57 farms, H5, H9, both H5 and H9 or non-H5 and non-H9 AIV were detected in 28, 9, 13 or 7 farms, respectively. Birds of most of the H5 AIV-positive farms did not present typical clinical signs or high mortality. Twenty such farms were observed longitudinally, which had only 1.05%–5.50% mortality but a marked drop in egg production.

Halder et al., (2021) Bacterial disease of poultry is one of the major constraints to the expansion of poultry industry. The study was undertaken to investigate some common bacterial diseases in commercial poultry farm. A total of 100 sick and dead chickens (67 broilers, 26 layers and 7 sonali) were collected from different poultry farms which were subjected to postmortem examination for tentative diagnosis. After the post-mortem examination, out of 100 collected dead chickens, bacterial diseases were confirmed 58 %. Among them 52 % of the chickens were diagnosed tentatively to be the case of colibacillosis, 4 % salmonellosis, and 2 % of fowl cholera. In postmortem examination, some pathological lesions like: omphalitis, fibrinopurulent fluid accumulation in peritoneal cavity, air sacculitis, pericarditis and perihepatitis, extreme congestion and septicemia in intestine for colibacillosis infection; unabsorbed yolk mass, bronze discoloration and friable liver, hemorrhages in spleen, misshaped ova for salmonellosis as well as swollen and hardening of comb, congestion of skin, multiple pin point pale color necrotic lesion on liver, pin point hemorrhage on fat muscle of heart were observed for fowl cholera infection.

Bhuiyan *et al.*, (2021) Infectious bronchitis virus (IBV) poses significant financial and biosecurity challenges to the commercial poultry farming industry. IBV is the causative agent of multi-systemic infection in the respiratory, reproductive and renal systems, which is similar to the symptoms of various viral and bacterial diseases reported in chickens. However, the immune response against IBV presents a dilemma due to the similarities between the different serotypes that infect poultry. Currently, the live attenuated and killed vaccines are applied for the control of IBV infection; however, the continual emergence of IB variants with rapidly evolving genetic variants increases the risk of outbreaks in intensive poultry farms. This review aims to focus on IBV challenge–infection, route and delivery of vaccines and vaccine-induced immune responses to IBV. Various commercial vaccines currently have been developed against IBV protection for accurate evaluation depending on the local situation.

Tipu *et al.*, (2021) Infectious diseases are one of the major constraints in Sonali chicken production in the Kishoreganj district of Bangladesh. However, the estimates of their prevalence including their pathological affections were limited. Therefore, we designed a retrospective cross-sectional study with a total of 362 Sonali birds from March 2018 to February 2019 to explore the prevalence and pathological changes of different infectious diseases in this district. Results showed that, coccidiosis attributed the highest prevalence (21.27%) in Sonali chickens among the infectious diseases, as the magnitudes of IBD (18.51%) and ND (14.64%) were moderate, whilst colibacillosis (5.53%), mycoplasmosis (5.25%), salmonellosis (3.59%), and fowl cholera (3.32%) showed a lower burden. The results also revealed a significant variation ($p < 0.05$) in the susceptibility to diseases at different ages; as 0-20 days age group was more susceptible to IBD, 21-40 days age group to coccidiosis, 41-60 days age group to ND, and above 60 days age group to colibacillosis. Despite a little variation in overall seasonal prevalence, some specific infectious diseases, like IBD showed a higher occurrence in the winter (26.32%) and summer (17.97%), while coccidiosis in the rainy season (26.32%), than other diseases.

Hasan *et al.*, (2020) Ducks are a natural reservoir of influenza A viruses (IAVs) and can act as a reassortment vessel. Wetlands, such as Hakaluki and Tanguar haor in Bangladesh, we collected a total of 947 samples including blood, oropharyngeal and cloacal swabs from domestic ducks (such as free-range ducks ($n = 312$ samples) and household ducks ($n = 635$ samples) in wetlands. We screened serum samples using a nucleoprotein competitive enzyme-linked immunosorbent assay (c-ELISA) to estimate seroprevalence of IAV

antibodies and swab samples by real-time reverse transcriptase polymerase chain reaction (rRT-PCR) to detect IA viral M gene. Eleven M gene positive samples were subjected to sequencing and phylogenetic analysis. Serological and viral prevalence rates of IAVs were 63.8% (95% CI: 60.6–66.8) and 10.7% (8.8–12.8), respectively. Serological and viral RNA prevalence rates were 51.8% (95% CI: 47.2–56.4) and 10.2% (7.6–13.3) in Hakaluki haor, 75.6% (71.5–79.4) and 11.1% (8.5–14.3) in Tanguar haor, 66.3% (62.5–69.9) and 11.2% (8.8–13.9) in household ducks and 58.7% (52.9–64.2) and 9.6% (6.5–13.4) in free-range ducks, respectively.

Ochuko Orakpoghenor *et al.*, (2020) studied infectious bursal disease (IBD) is an immunosuppressive disease of poultry causing great economic losses to the poultry industry. Based on virus neutralisation, two serotypes of IBDV have been identified (serotypes 1 and 2), with serotype 1 considered to be virulent. Acute clinical outbreaks of classical IBDV are characterised by sudden onset, high morbidity, spiking and mortality curves with a rapid recovery time of about five to seven days, after clinical signs appear. Mortality rates vary within serotype 1 IBDV strains, ranging from no mortality by the variant strains, about 20% mortality with classical strains and over 50% mortality by very virulent strains. *Post-mortem* lesions are commonly, but not exclusively, reported in the bursa of Fabricius (BF) observed as haemorrhages, swelling and atrophy.

Moryani *et al.*, (2020) identified the common diseases of broiler at farm level were *E.coli* (81%), IBD (69%), CRD (67%), infectious bronchitis (13%), mycotoxins (5%), salmonellosis (4%), Newcastle disease (3%) and Cocci (2%). While in layers occurrence of cholera (60%), avian influenza (45%), *E.coli* (12%), mycotoxins (10%), IB (8%), CRD (5%), Marek's (5%), New castle disease (4%), salmonellosis (2%) and Hydro Pericardium Syndrome (2%) were identified. Birds in group-C, D & G supplemented with Giloy/Satgullo, Tabashir & Gadamri/Imli consumed more feed (3040, 3000 & 3000g/ bird) than group-B, F & E (2980, 2948 & 2871g/ bird) fed with Aloe vera, Hing/Vaghayani & Anwara herbs and against control group-A (2770g/bird). The FCR values of group-F, E, G, C & D (1.40, 1.45, 1.47, 1.50 and 1.50) fed with Hing/Vaghayani, Anwara, Gadamri/Imli, Tabashir & Giloy herbs were statistically lower against group-A (1.70) and group-B (1.62).

Sayeed *et al.*, (2020) descriptive epidemiological study has been conducted and a total of 960 clinical cases were recorded during the study period. Ectoparasitic cases were proportionately higher in cattle (25.2%), whereas Peste des Petits Ruminants (PPR) cases

were more frequent in goat (53.4%). The proportionate prevalence of other cases in cattle was Fascioliasis (14.3%), Myiasis (11.2%) and Foot and Mouth Disease (FMD) (7.2%). The proportionate prevalence of other cases in goats were vitamin and mineral deficiency (12.3%), bloat (5.2%), abscess (4.7%), and dog bite (1.2%). Again, the proportionate prevalence of poultry diseases were Infectious Bursal Disease (IBD) (41.2%), salmonellosis (33.4%), fowl cholera (13.7%) and pox (7.8%).

Moula *et al.*, (2020) a total of 540 broiler birds were collected from four different places from January to December 2017 and necropsied. Five body systems including gastrointestinal, respiratory, immune, skeletal, and integumentary were monitored with their 33 parameters during the study period. All the scores obtained from different parameters were analyzed and summarized. Among the body systems, lesion scores percentages were more prevalent in the parameters of the gastrointestinal, respiratory, and immune systems. Regarding age groups, 2nd (0-84.4%) and 3rd weeks (0-78.3%) had most of lesion scores percentage compared to 4th weeks (0-70.6%). With respect to season, lesion scores percentages were highest in summer (0-87.2%) and winter season (0-76.7%) respectively than monsoon season (0-68.3%). Based on different scores, zero was scored by the most number of birds ranged from 22.6-100%, while one was scored in 0-66.9%, two in 0-15.2%, three in 0-5.9%, and four in 0-0.4% of birds, respectively. Flock health monitoring program is a mirror of flock health status that can be a great alternative for the poultry industry and manager. Thus, the flock monitoring program mainly emphasizes poultry health which can be a good approach for future disease prevention.

Sali (2019) studied infectious bursal disease (IBD) is an infectious viral disease of poultry. It is caused by infectious bursal disease virus (IBDV) that is a member of the genus Avibirnavirus of the family Birnaviridae. The virion is non-enveloped and consists of a bi-segmented RNA molecule. The disease occurs in a clinical and subclinical form depending on age at infection. Only young chickens are clinically affected. Severe acute disease of 3-6 week old birds is associated with high mortality but a less acute or subclinical disease is common in 0-3-week-old birds. This can cause secondary problems due to the effect of the virus on the bursa of Fabricius. There are two serotypes of IBDV; These are serotype 1 which is pathogenic to chickens and commonly leads to the development of the clinical form of the disease and serotype 2 is avirulent to chickens.

Alam Sarker *et al.*, (2019) observed the overall prevalence of bacterial diseases was recorded as 14.05% whereas layer chickens (9.54%) and broiler chickens (4.50%). During the study, the prevalence of Salmonellosis was found 8.22% whereas 11.66% in layer chickens and 3.25% in broiler chickens. On the other hand, the prevalence of Colibacillosis was identified 5.83% in chickens in which 3.18% were broiler chickens and 2.65% were layer chickens. In the case of Salmonellosis, grossly livers were friable, congested, enlarged, bronze discoloration with white focal necrosis, egg follicles were congested and hemorrhagic with stalk formation; microscopically livers formed multifocal nodules with coagulation necrosis. Birds with Colibacillosis grossly showed fluid accumulation in the peritoneal cavity of chicks, dark-colored swollen liver and spleen, and perihepatitis.

Matin *et al.*, (2017). This study was conducted for determination of the prevalence of colibacillosis in chicken in poultry farms in Mymensingh and Tangail districts. Isolation, identification, and antibiogram profile of *Escherichia coli* were also performed. A total of 25 chickens manifested clinical signs of colibacillosis were collected from five different poultry farms during natural outbreaks. In broiler, the prevalence of colibacillosis was 0.84%, and in layer, prevalence was 0.80%. The prevalence of colibacillosis was 1.0% and 0.5% in 25-30 days old and 31-35 days old broiler, respectively. In case of layer birds, the prevalence was 0.6% in 40-45 days old bird and 1% in 46-50 days old bird. Identity of the *E. coli* isolate of chicken was confirmed by sugar fermentation, biochemical tests, and polymerase chain reaction assay. Antibiogram profile of *E. coli* isolate of chicken revealed that it was multidrug resistant (resistant against two antibiotics, such as ampicillin and cefalexin). Data of this study suggest that colibacillosis is prevalent in the study areas which underscore the need of implementation of prevention and control measure against this disease.

Talukder *et al.*, (2017) was conducted to determine the prevalence of infectious diseases in Sonali chickens at Bogra Sadar Upazila, Bogra, Bangladesh. A total of 258 sick and dead Sonali chickens were examined for the diagnosis of different infectious diseases based on history, clinical findings and postmortem lesions of dead and sacrificed birds. Infectious Bursal disease (IBD) was recorded in 14.72% (n=38/258) cases. Similarly, Newcastle disease (ND), Coccidiosis, Colibacillosis and Mycoplasmosis were recorded in 11.24% (n=29/258), 13.95% (n=36/258), 14.72% (n=38/258), 12.79% (n=33/258) cases, respectively. Mixed

infection of IBD, ND and Coccidiosis found in 16.67% (n=43/258) birds. On the other hand, mixed infection of IBD, ND and colibacillosis was recorded in 15.89% (n=41/258) cases. It is concluded that several infectious diseases are commonly present in Sonali chicken in the study area of Bangladesh.

Wong *et al.*, (2017) studied Small-scale poultry production systems are mostly found in rural, resource-poor areas that often also experience food insecurity. They are accessible to vulnerable groups of society, and provide households with income and nutritionally-rich food sources. However, they also improve food security in indirect ways, such as enhancing nutrient utilisation and recycling in the environment, contributing to mixed farming practices, contributing to women's empowerment, and enabling access to healthcare and education. Further, they may contribute to several of the Sustainable Development Goals, and to future food security through maintaining biodiverse genomes. In extensive small-scale poultry production systems, significant impediments to achieving these contributions are disease and predation, which can be reduced through improved agricultural and livestock extension and community animal health networks. For small-scale intensive systems, feed price fluctuations and inadequate biosecurity are major constraints.

Hasan *et al.*, (2016) encountered diseases in layers were bacterial diseases 52.29% (salmonellosis 38.56%, colibacillosis 6.7%, fowl cholera 4.79% and necrotic enteritis 1.60%), viral diseases 23.95% (avian influenza 2.56%, Newcastle disease 16.61%, infectious bronchitis 3.19% and avian leucosis 0.64%), mycoplasmal disease (mycoplasmosis 14.70%) and protozoal disease (coccidiosis 5.75%). Salmonellosis was most prevalent disease in age group of >20 weeks, while Newcastle disease most common in 8 to 20 weeks of age group. In case of broiler, bacterial diseases 28.99% (salmonellosis 21.30% and colibacillosis 7.69%), viral diseases 53.24% (infectious bursal disease 28.99%, Newcastle disease 8.87% and infectious bronchitis 15.38%), mycoplasmal disease (mycoplasmosis 7.1%) and protozoal disease (coccidiosis 6.5%). In cockrels, the most prevalent disease was colibacillosis 35.71% followed by salmonellosis 28.57%, Newcastle disease 14.28% and mycoplasmosis 14.28%.

Munmun *et al.*, (2016) was conducted to evaluate the prevalence of Newcastle Disease (ND) in pigeon, chicken and duck at selected Veterinary Hospital, in Bangladesh and India during December 2015 to May 2016. A total of 245 ND cases were identified by anamnesis, manifesting signs and clinical and physical examination and occasionally postmortem examination. The proportionate prevalence was found higher in pigeon (58.9%) irrespective

of study placements. The prevalence of ND was highest in summer season (50.6%) and lowest in rainy season (10.2%). Younger birds 20 to 65% are more susceptible to ND irrespective of age. The proportionate prevalence in male and female was 14.2 to 53.8% and 16.7 to 60.9%, respectively. Among the body system digestive system was more affected (42.04%) than the nervous system (20%).

Rashid *et al.*, (2012) was undertaken the incidence rate (true incidence rate) of mortality for the study period was 0.0171 per bird-months at risk. The incidences of mortality of almost all the infectious diseases were significantly higher in rainy followed by summer seasons. Particularly, mortality rate of ND and FC was significantly higher in rainy and summer seasons compared to winter and autumn seasons. And higher mortality rate of IBD, salmonellosis, IB, colibacillosis and MD was found in rainy than other three seasons. The highest mortality was recorded in birds below 8 weeks of age followed by birds aged 21 weeks and above. The mortality due to IBD was significantly higher (0.006) in the young birds (<8 weeks of age) than older birds. On the other hand, mortality rate of ND was significantly higher (0.003) in older birds (>8 weeks of age). Statistically no significant difference ($p>0.05$) was observed in the mortality rate of colibacillosis between different age groups. The proportional mortality due to infectious diseases was 54.2% (including single or mixed infections). Of the overall mortality, 13.4% was attributed to ND, 9.53% to IBD, 6.69% to MD, 4.33% to IB, 4.23% to salmonellosis, 3.23% to FC, 3.31% to colibacillosis, 1.1% to aspergillosis and 45.8% to non-infectious causes.

Hoque *et al.*, (2011) was conducted on 118 households (N = 1,373 Jinding ducks, *Anas platyrhynchos*) from December 2002 to February 2004 on Hatia Island in Bangladesh with the aim of identifying the factors that limit the health and production of Jinding ducks. Overall duck mortality was 29.3%, with disease (19.7%) being a more significant factor than predation (9.6%; $p = 0.001$). Duck mortality also varied significantly among study zones ($p < 0.001$). Common diseases were duck plague (21.1%) and duck cholera (32.1%). Helminth infection was prevalent, with endemic trematode (*Prosthogonimus* spp., *Trichobilharzia* spp., *Echinostoma* spp.) and nematode (*Cyathostoma bronchialis*, *Amidostomum anseris*, *Heterakis gallinarum*, *Capillaria* spp., and *Echinuria* spp.) infections and epidemic cestode infections due to *Hymenolepis setigera*. The median egg production rate per duck per household was 93 for a 6-month laying period.

Islam *et al.*, (2008) was performed retrospective histopathological on clinical samples and sero-prevalence of avian leukosis virus antibodies in layer farms were done. Histopathological samples (Liver) were preserved in 10% neutral buffered formalin and processed, embedded in paraffin, sectioned and stained using standard histopathological techniques. For ELISA, eggs (n=2) and blood samples (n=10) were collected antibody titre were measured by ELISA. Histopathological lesions of clinical samples were homogenous population of lymphoblasts appeared as either nodular or diffuse form with numerous mitotic figures, displacement and compression of the hepatic parenchyma by the accumulation of large number of neoplastic lymphocytes. Among the 100 egg yolk samples, 43 samples were positive for antibodies to ALV. Among the 10 serum samples, 6 samples were positive for antibodies to ALV. Out of total 110 samples, 49 samples were positive. Overall prevalence of avian leukosis was 44.6%. Prevalence of 5 selected layer farm varied from 25% - 65%, and the height (60%) prevalence of antibodies to avian leukosis of BAU Poultry Farm.

Biswas *et al.*, (2006) determined the causes of loss of 'Sonali' (male symbol Rhode Island Red x female symbol Fayoumi) chickens at key-rearers' households of the smallholder livestock development project-2 (SLDP-2) area in Bangladesh. A key rearer is a smallholder of chickens in the 'village poultry-production chain' (undertaken by SLDP-2 under the financial assistance of the DANIDA) who rears at least five Sonali and some 'Deshi' (non-descriptive and indigenous) chickens in their homesteads based on semi-scavenging system. Incidence rates of loss of Sonali chickens from disease, predation, selling and slaughtering were 0.025, 0.023, 0.081 and 0.039 per bird-month at risk, respectively. The major predators of Sonali chickens in the study area were foxes, a kind of wild cat (*Felis chaus*), mongooses and human thieves. Colibacillosis (both single and mixed infections) had a contributory role in the death of 28% of dead Sonali birds collected for diagnosis; salmonellosis, Newcastle disease and internal parasites contributed to the next highest (14, 11 and 10%) proportional mortalities.

Boltz *et al.*, (2004) Avian infectious bronchitis virus (AIBV) is a coronavirus known to cause an acute respiratory infection in chickens. AIBV not only grows in respiratory tissue, but also in nonrespiratory organs such as the kidney, the female reproductive tract, intestine, and spleen of chickens (11). The virus has received attention because of its negative economic impact on poultry. AIBV causes economic loss to the poultry industry, not only as a result of

high morbidity and, in some instances, mortality, but also from the debilitating nature of the disease resulting in poor use of feed by young chickens. Several AIBV strains have been isolated that are known to infect the kidney. In the kidney, AIBV causes tubule dilation and kidney lesions of varying degrees (1,2,3). The major economic loss is from ovarian damage and the precipitous and prolonged decrease in egg production in laying flocks.

Giasuddin et al., (2002) The postmortem and serological investigations of poultry diseases were conducted in different farms of Bangladesh. A total numbers of 1653 either dead or sick birds were examined. The incidence of aflatoxicosis was highest (27.59%) followed by nutritional deficiency (12.40%), infectious bursal disease (11.80%), chronic respiratory disease (8.11%) newcastle disease (7.50%) salmonellosis (5.56%) colibacillosis (4.42%), fowl cholera (3.08%) were found. 5.32% cases remain undiagnosed due to lack of diagnostic facilities or autolysis of the bird. In sero-evaluation, commercial and native birds were found 93-97, 80 -55, 56-12, 60-73, 67-61 and 22-3% sero-positive for newcastle disease, infectious bursal disease, pullorum, *M. galisepticum*, *M. synovie* and chicken infectious anemia respectively.

Berchieri et al., (2001) Commercial laying hens inoculated with a strain of *Salmonella enterica* ser. pullorum when they were 4 days old showed no morbidity, but harboured infection until they came into lay, and then produced *S. pullorum*-contaminated eggs and infected progeny. There was limited evidence of transmission of maternal immunity to the progeny. Attempts were made to set up similar infections in hens with *Salmonella gallinarum*, but without success. Infection either resulted in clinical disease or elimination of the pathogen. Infection of birds when in lay produced a similar result. The possibility of eggs becoming contaminated with *S. gallinarum* after they were laid in the nest box was evaluated but there was no evidence for this. In-bred chicken lines with a *SalI*-susceptible phenotype showed greater localization of *S. Pullorum* in the reproductive tract than did a *SalI*-resistant line. In addition, in-bred birds, which were *SalI* resistant but showed greater susceptibility to intestinal colonization by *Salmonella*, infected with *S. Gallinarum* when they were 1 week old, showed longer term persistence in the liver and spleen than did a resistant line.

2.2 Viral diseases of commercial chicken

2.2.1 Newcastle Disease (ND)

Mngumi *et al.*, (2022). The present study intended to determine the prevalence of Newcastle disease in unvaccinated backyard poultry in Africa. Using the PRISMA approach, a systematic review and meta-analysis of 107 epidemiological studies was conducted. The meta-analysis identified significant variation of both seroprevalence ($I^2 = 99.38$, $P = 0.00$) and Newcastle disease virus prevalence ($I^2 = 99.52$, $P = 0.00$) reported in various studies included in this review. Publication bias was not detected in either case. Seroprevalence of Newcastle disease was 40.2 (95%CI 32.9–47.8). Seroprevalence was significantly influenced by sampling frame and the African region where the studies were conducted. The prevalence of Newcastle disease virus (NDV) was 12% (95%CI 7.3–17.8), and the variation was influenced by sampling frame, diagnostic test, and regions where the studies were conducted. Also, Newcastle disease (ND) accounted for 33.1% (95%CI 11.9–58.1) of sick chickens.

Chang and Dutch (2012) studied the paramyxovirus family contains many common human pathogenic viruses, including measles, mumps, the parainfluenza viruses, respiratory syncytial virus, human metapneumovirus, and the zoonotic henipaviruses, Hendra and Nipah. While the expression of a type 1 fusion protein and a type 2 attachment protein is common to all paramyxoviruses, there is considerable variation in viral attachment, the activation and triggering of the fusion protein, and the process of viral entry. In this review, we discuss recent advances in the understanding of paramyxovirus F protein-mediated membrane fusion, an essential process in viral infectivity.

Cattoli *et al.*, (2011) reviewed details the pertinent features of the clinicopathologic disease in the main susceptible species, including chicken, turkey, duck, goose, pigeon, and other birds such as cormorants, psittacines, and canaries. Furthermore, the available and emerging laboratory diagnostic methodologies for the detection and typing of the virus are reviewed, including traditional techniques such as virus isolation and immunohistochemistry as well as rapid procedures based on molecular tools, such as real-time polymerase chain reaction, gene sequencing, and microarrays. The relevant genetic variability of ND viruses probably represents the major limitation in the validation and application of the current, advanced diagnostic molecular techniques.

Miller *et al.*, (2010) Since the discovery of Newcastle disease virus (NDV) in 1926, nine genotypes of class I viruses and ten of class II have been identified, representing a diverse and continually evolving group of viruses. The emergence of new virulent genotypes from global epizootics and the year-to-year changes observed in the genomic sequence of NDV of low and high virulence implies that distinct genotypes of NDV are simultaneously evolving at different geographic locations across the globe. This vast genomic diversity may be favored by the large variety of avian species susceptible to NDV infection and by the availability of highly mobile wild bird reservoirs. The genomic diversity of NDV increases the possibility of diagnostic failures, resulting in unidentified infections. Constant epidemiological surveillance and pro-active characterization of circulating strains are needed to ensure that the immunological and PCR reagents are effective in identifying NDV circulating worldwide.

2.2.2 Infectious Bronchitis

Pinto *et al.*, (2022). Infectious bronchitis virus (IBV) and avian reovirus (ARV) cause significant losses in the poultry industry throughout the world. A cross-sectional study was conducted in four villages in Manjacaze district, Southern Mozambique, to determine the seroprevalence of IBV and ARV. A total of 467 serum samples from adult unvaccinated backyard chickens were screened using commercial and competitive enzyme-linked immunoabsorbent assay kits. Our results showed anti-IBV and anti-ARV antibodies in all surveyed households and villages. The overall seroprevalence was 89.5% (95% confidence interval [CI]: 77.2-97.4) and 95.7% (95% CI: 88.0-99.2) for IBV and ARV, respectively. The risk of becoming exposed to IBV was lower in Chidenguele village compared with the other three villages ($p < 0.05$). However, no statistically significant differences were observed for becoming exposed to ARV between villages ($p > 0.05$). The backyard chickens tested in this study had no previous history of vaccination, outbreaks or typical clinical signs of IB and AR diseases.

Bhuiyan *et al.*, (2019) determined the prevalence of infectious bronchitis virus (IBV) as well as virus isolation, identification, and molecular characterization of various strains circulating in Bangladesh. Out of 371 samples, 65 samples were positive in reverse transcriptase polymerase chain reaction (RT-PCR) for molecular identification of IBV. The overall prevalence was 17.52% recorded and among the selected types of chicken, the highest

prevalence of IBV was found in layer that was 42.22% followed by 17.24% in Sonali, 14.93% in broiler breeder, and lowest prevalence was 11.94% in broiler chicken, respectively. Moreover, the prevalence of IBV was recorded highest in aged chicken at 41-60 weeks, which was 54.55% in layer, 27.27% in Sonali, and, afterward, 14.68% was found in broiler breeder, respectively. Frequency of IBV more frequently in winter (22.67%) followed by rainy (15.87%) and summer season (11.58%). The highest prevalence of IBV was found Tangail district (41.67%) followed by Mymensingh (24.42%), Gazipur (19.32%), Dhaka (15.38%), Jamalpur (16.67%), Bogura (13.68%), Cumilla (5.88%), and Rangpur (9.26%), respectively.

2.2.3 Infectious Bursal Disease (Gamboro)

Milli *et al.*, (2022) collected a total of 460 serum samples were randomly collected from backyard chickens that had not been previously vaccinated against IBDV. The collected sera were examined using an enzyme-linked immunosorbent assay (ELISA). Data on epidemiological risk factors were collected through face-to-face interviews with owners and subjected to both uni- and multivariable risk analyses to determine their association with IBDV infection. Using ELISA, the overall seroprevalence of IBDV antibodies in backyard chickens was 83.4% (95% confidence interval: 79.8%–86.6%), among which, a significantly higher seroprevalence was recorded in females (83.4%, 345/350), 4–6 weeks age group (95.3%, 244/256), and unhealthy (95.0%, 57/60) backyard chickens than those of males, other age groups, and healthy chickens, respectively. Furthermore, chickens reared in free-ranging housing systems (93.3%, 280/300) and poor-conditioned houses (98.0%, 147/150) showed a significantly higher seropositivity of IBDV antibodies than those reared in separated housing systems and other hygienic-conditioned houses, respectively. Moreover, compared with their counterparts, a higher but nonsignificant seroprevalence of IBDV antibodies was observed in backyard chickens that were selected from Fulbaria Upazila (88.8%; 80/90) and which were brought from the marketplace (85.7%, 60/70).

Abdeta *et al.*, (2022) conducted with the aim of determining seroprevalence and associated risk factors of IBD in backyard and intensively managed chickens of the study area. A cross-sectional study was conducted in selected districts of western Oromia on intensive and backyard production systems to investigate seroprevalence of IBD and associated risk

factors from September 2020 to August 2021. A total of 384 chickens of either sex, 128 from each district, were included from three randomly selected peasant associations (PAs). In addition, 180 individual poultry keepers, of both sexes, and different educational backgrounds, were included for questionnaire survey. Data were analyzed using SPSS Version-20, and results were presented as percentages. The samples were processed by using (ProFLOKIBV, USA) indirect enzyme-linked immunosorbent assay (I-ELISA) kits. Out of 384 serum samples tested, 66.93% ($n = 257$) were found positive by indirect ELISA. The highest prevalence was recorded from Sasiga district Balo Bareda PA. Prevalence of IBD showed significant statistical association ($p < 0.05$) among owner education level, chicken rearing practice, origin and breed.

2.1.4 Inclusion Body Hepatitis (IBH)

El-Shall *et al.*, (2022) Infection with fowl adenoviruses (FAdVs) can result in a number of syndromes in the production of chicken, including inclusion body hepatitis (IBH), hepatitis-hydropericardium syndrome (HHS), and others, causing enormous economic losses around the globe. FAdVs are divided into 12 serotypes and five species (A-E; 1-8a and 8b-11). Most avian species are prone to infection due to the widespread distribution of FAdV strains. The genus aviadenovirus, which is a member of the adenoviridae family, is responsible for both IBH and HHS. The most popular types of transmission are mechanical, vertical, and horizontal. Hepatitis with basophilic intranuclear inclusion bodies distinguishes IBH, but the buildup of translucent or straw-colored fluid in the pericardial sac distinguishes HHS. IBH and HHS require a confirmatory diagnosis because their clinical symptoms and postmortem abnormalities are not unique to those conditions.

Bertran *et al.*, (2021) A surge in fowl adenovirus (FAdV) causing inclusion body hepatitis (IBH) outbreaks has occurred in several countries in the last two decades. In Spain, a sharp increase in case numbers in broilers and broiler breeder pullets arose since 2011, which prompted the vaccination of breeders in some regions. Our retrospective study of IBH cases in Spain from 2011 to 2021 revealed that most cases were reported in broilers (92.21%) and were caused by serotypes FAdV-8b and -11, while cases in broiler breeder pullets were caused by serotypes FAdV-2, -11, and -8b. Vertical transmission was the main route of infection, although horizontal transmission likely happened in some broiler cases. Despite

the inconsistent and heterogeneous use of vaccines among regions and over time, the number of cases mirrored the use of vaccines in the country.

Shrivastava *et al.*, (2019) A study was conducted to study the prevalence of Fowl adenovirus infections in broilers and Kadaknath birds in Malwa region of Madhya Pradesh during July 2016- March 2017. Overall 2.78% mortality was recorded at 30 broiler farms. Total mortality recorded at Kadaknath farms was 6.84%. Age-wise highest mortality in broiler farms was recorded at 3rd week of age and highest mortality was recorded at 1st week and 3rd week of age respectively at Mhow and Jhabua kadaknath farms. Disease-wise highest mortality in broilers was recorded due to IBH-HPS (1.6%) followed by colibacillosis. At Kadaknath farm Mhow and Jhabua maximum mortality was recorded due to yolk sac infection (2.83%) and coccidiosis (1.90%) respectively.

Niu *et al.*, (2018) One hundred and five fowl adenovirus (FAdV) strains were isolated in China from 2015 to 2016 from poultry with inclusion body hepatitis (IBH) and hydropericardium syndrome (HPS). Polymerase chain reactions determined that 68 were FAdV species C, five were FAdV species D, two were FAdV species E, and 30 contained two or more different FAdV strains. A phylogenetic analysis showed that the isolated FAdV strains clustered into three major groups: FAdV-C, FAdV-D and FAdV-E. Based on a hexon gene sequencing analysis, these viruses were genetically related to FAdV-4, FAdV-7, FAdV-8b and FAdV-11, of which FAdV-4 was dominant (93% of the strains). An epidemiological analysis showed that FAdVs had been circulating in broilers, domestic chickens, and layers, and co-infections with other immunosuppressive pathogens, such as chicken infectious anaemia virus, Marek's disease virus and reticuloendotheliosis virus, were identified. To control FAdVs, strict biosecurity protection measures are necessary, and a continued surveillance of FAdVs is needed to increase our understanding of the epidemiology of the viruses that are associated with IBH and HPS.

Asthana *et al.*, (2013) Hydropericardium syndrome (HPS) was initially reported from Angara Goth, Pakistan, and then from India during 1994, in the poultry belt of Jammu and Kashmir, and thereafter, from almost all parts of the country, causing heavy economic losses to the poultry industry. The disease occurs predominantly in broilers of the age group of 3-5 weeks, characterized by sudden onset of high mortality up to 80 %. The causative agent of HPS is fowl adenovirus 4, which is a member of the species Fowl Adenovirus C, genus Aviadenovirus, family Adenoviridae [60]. FAV-4 is non-enveloped and icosahedral in

shape, measuring 70-90 nm in size and containing a linear dsDNA of approximately 45 kb in size as its genome. The livers of affected birds show necrotic foci and basophilic intranuclear inclusion bodies in the hepatocytes.

Choi *et al.*, (2012) In total, 39 clinical cases of fowl adenoviruses (FAdV) infection in chickens (28 broiler, 7 native, and 4 layer chickens) between 2007 and 2010 in Korea were investigated. The FAdV types 4, 8b, and 11 comprised 18, 9, and 12 clinical cases, respectively. All FAdV type 4 cases showed clinical hydropericardium (HPS) lesions as well as inclusion body hepatitis (IBH), whereas all FAdV types 8b and 11 cases exhibited IBH lesions without HPS. All 3 types were detected in broiler (9-30 d old) and layer chickens (23-112 d old), whereas most native chickens (14-65 d old) were affected only by FAdV type 4. Infectious bursal disease virus and chicken infectious anemia virus were complications in 51.3% of FAdV cases, with mortalities of 55% to <0.1%. Chicken infectious anemia virus was detected in all native chicken cases.

Nakamura *et al.*, (2011) The mortality rates were from 1.2% to 17.0% in affected flocks. Inclusion body hepatitis (IBH) was detected in 13 prefectures (northern, eastern, western, and southern areas) in Japan. The livers were enlarged and pale. The bursa of Fabricius and thymus had not atrophied. Multifocal necroses of hepatocytes with basophilic intranuclear inclusions were seen in the liver. Eosinophilic intranuclear inclusion bodies in hepatocytes were rare. Focal necrosis of acinar cells with basophilic intranuclear inclusions was found in the pancreas. Basophilic intranuclear inclusion bodies were detected in intact surface epithelial cells of gizzard and epithelial cells of the small intestine. The intranuclear inclusions of liver, pancreas, gizzard, and small intestine were stained positively for immunohistochemistry of fowl adenovirus (FAV) antigen. Ultrastructurally, basophilic intranuclear inclusions consisted of viral particles approximately 70 nm in diameter and arranged in a crystalline array.

Senties-Cué *et al.*, (2010) In 2007, an inclusion body hepatitis (IBH) outbreak affected several broiler farms in Mississippi. Results of linear regression model analyses showed significant associations between IBH occurrence with average weight and with cost deviation. Broiler meat production cost was \$0.0058/kg more expensive to produce when IBH occurred. Although feed conversion was higher with IBH occurrence, the association was not significant. IBH onset in the first farms affected occurred between 19 and 30 days of age, whereas in the last farms affected, IBH onset occurred as early as 10 days.

Balamurugan and Kataria (2004) Inclusion-body hepatitis hydropericardium syndrome (IBH-HPS) is an important, recently emerged, disease of poultry, particularly of 3- to 6-week-old broiler chicks, characterized by its sudden onset, with high mortality ranging from 20% to 70%, typical hydropericardium and enlarged mottled and friable livers, with intranuclear inclusion bodies in the hepatocytes. The causative agent is a non-enveloped icosahedral fowl adenovirus (FAV) serotype 4, belonging to the Adenovirus genus of the family Adenoviridae, which can be propagated or cultivated in chicken embryo liver and kidney primary cell cultures. The transmission of disease occurs vertically and laterally by the oral-faecal route. The liver of infected birds shows necrotic foci and basophilic intranuclear inclusion bodies in the hepatocytes.

2.3 Bacterial Disease

2.3.1 Salmonellosis (Fowl Typhoid)

Sun et al., (2021) Foodborne disease caused by *Salmonella* is an important public health concern worldwide. Animal-based food, especially poultry meat, is the main source of human salmonellosis. The objective of this study was to evaluate the prevalence and epidemiology of *Salmonella* contamination in raw poultry meat commercialized in China. Following the principle of systematic review, 98 sets of prevalence data were extracted from 74 publications conducted in 21 Chinese provincial regions. The random-effect model was constructed for subgrouping analysis by meat category, preservation type, and geographical location. The prevalence levels differed from high to low among raw poultry meat, including chicken, 26.4% (95% CI: 22.4–30.8%); pigeon, 22.6% (95% CI: 18.2–27.8%); duck, 10.1% (95% CI: 5.3–18.2%); and other poultry meat, 15.4% (95% CI: 12.0–19.5%).

Haider et al., (2004) A locally isolated *Salmonella Gallinarum* (SG) was used for fowl typhoid vaccine production. 2×10^7 colony forming unit (CFU) of SG was used for the vaccine production. The fowl typhoid vaccine was produced with the local isolates of SG (LRI 49) strain. Efficacy study of the vaccine was performed primarily in laboratory trial in 6 weeks and then in 8 weeks old commercial layers in the field. Chickens were boosted after 4 wks of vaccination. Rapid serum plate agglutination (SPA) test and ELISA were carried out for the detection of antibody response against SG vaccinated and non-vaccinated birds. Positive results of the rapid plate agglutination and the ELISA were 81% and 77% in laboratory trial, and 76.4% and 73.8% in field trial, respectively.

2.3.2 Pasteurellosis (Fowl Cholera)

Raji *et al.*, (2010) Fowl cholera is a contagious bacterial disease of domestic and wild avian species.

The infection is caused by *Pasteurella multocida*. The data for this study was obtained from the Diagnostic Microbiology laboratory of the Department of Veterinary Pathology and Microbiology and Veterinary Teaching Hospital of Ahmadu Bello University, Zaria between the year 2001 and 2005. Prevalence rate of avian pasteurellosis obtained in this study were 2.3%, 6.4%, 1.5%, 4.6% and 7.4% for 2001, 2002, 2003, 2004 and 2005 respectively. The results showed that there was an increase in the prevalence of avian pasteurellosis from 2001 to 2005. There was also variation in the monthly distribution of avian pasteurellosis in Zaria, with highest number of cases in April and in August accounting for 35% and 25% respectively.

Taunde *et al.*, (2017) A total of 398 serum samples from free-range indigenous chickens originating from four villages in Southern Mozambique were tested for the presence of avian encephalomyelitis virus (AEV) and *Pasteurella multocida* (PM) antibodies through commercial enzyme-linked immunosorbent assay (ELISA) kits. AEV and PM antibodies were detected in all villages surveyed. The proportion of positive samples was very high: 59.5% (95% confidence interval (CI) 51.7-67.7%) for AEV and 71.5% (95% CI 67.7-77.3%) for PM. Our findings revealed that these pathogens are widespread among free-range indigenous chickens in the studied villages and may represent a threat in the transmission of AEV and PM to wild, broiler or layer chickens in the region.

2.2.3 Colibacillosis

Khatun *et al.*, (2021) This study was carried out to investigate the prevalence and pathological lesions of avian colibacillosis in commercial broiler farms at Dinajpur Sadar Upazila (Sub-district) from July to December 2018. A total of 8800 birds from six farms were diagnosed with colibacillosis from clinical signs, post-mortem lesions and histopathological changes. Highest prevalence was in F1 farm (76.2%) and lowest in F6 farm (9.2%). Highest mortality was in F1 farm (9.1%) and lowest in F6 farm (3.3%). Average prevalence was 39.6% and mortality 5.4%. Highest prevalence was at 0-2 weeks of age (69.3%) and lowest at 2-4 weeks of age (9.6%). The most common gross lesions were air sacculitis, omphalitis, pericarditis, perihepatitis, peritonitis and enteritis. The microscopic lesions were haemorrhage and congestion in lung, destruction of intestinal wall and reactive cell infiltration, and thickening of fibrous tissue in pericardium.

Kromann *et al.*, (2022) aimed to unveil lesions leading to mortality in a study population perceived as healthy, combined with whole-genome sequencing (WGS) of *Escherichia coli*, a well-known contributor to disease problems in poultry. Broiler breeders (n = 340) originating from three distinct, putative healthy flocks and their progeny (n = 154) were subjected to a comprehensive post-mortem examination, bacteriological sampling, and sequencing of 77 *E. coli* isolates. Productivity data confirmed an exemplary health status of the enrolled flocks, and post-mortem examination further verified the absence of general disease problems. Among the submitted broiler breeders, exudative peritonitis (31.2%) was the most frequent lesion linked to infectious disease, whereas airsacculitis, pericarditis, perihepatitis, and salpingitis occurred in 18.5%, 3.5%, 3.8% and 17%, respectively. Yolksacculitis occurred in 15.6% of the broilers, whilst pericarditis, perihepatitis and peritonitis were diagnosed in 9.7%, 7.1% and 9.1%, respectively.

2.4 Mixed Infection

2.4.1 Chronic Respiratory Disease (CRD)

Cortés *et al.*, (2021). *Mycoplasma* species are worldwide recognized poultry pathogens, with *Mycoplasma synoviae* being the second most important species from the clinical point of view that causes considerable economic losses in the poultry industry. The aim of this study was to assess the seroprevalence, prevalence, and phylogenetic variants of *M. synoviae* present in layers and broiler breeders' farms of *Gallus gallus* species located in eastern Spain. Thus, 19 and 23 flocks of layers and broiler breeders, respectively, were analyzed at 3 different ages. To assess seroprevalence, sera samples were analyzed by ELISA. Tracheal swabs were tested by PCR to assess the prevalence. A *M. synoviae* seroprevalence of 95 and 74% was detected in layers and broiler breeders, respectively. Regarding age-wise analysis, the positive rates obtained seemed to be higher as the age of sampling increased. As per PCR results, a prevalence of 95% in layers and 35% in broiler breeders was obtained. The genetic analysis showed that the strains present in broilers breeders were vaccine strains (MS H strain).

2.5 Parasitic Disease

2.5.1 Coccidiosis

Belal, (2017) The study was conducted to ascertain the prevalence of coccidiosis in Sonali birds in Sirajgonj district of Bangladesh during the year 2015-2016. Diagnosis was made on the basis of history, clinical and post mortem findings. A total of 660 samples (sick and dead birds) were examined where 234 (35.45%) samples were found positive for coccidiosis. The highest prevalence percentage was found in July (53.33%) and the lowest percentage was found in January (16.67%). Birds aged 5 to 6 weeks showed more prevalence percentage (47.50 %), whereas older birds (> 16 weeks) found less susceptible (10%) to coccidiosis. Coccidiosis was slightly more prevalent in female (37.70%) than male (32.22%).

Sharma *et al.*, (2015) In this study prevalence of chicken coccidiosis in Jammu division were undertaken in both organized and backyard chickens during the year 2010–2011, with an overall prevalence of 39.58 % on examination of 720 faecal samples. Five *Eimeria* species were identified viz., *E. tenella*, *E. necatrix*, *E. maxima*, *E. acervulina* and *E. mitis*. *E. tenella* was the predominant species in both organized and unorganized farms. The highest prevalence percentage was found in July, 2011 (68.9 %) and the lowest percentage was found in May, 2011 (12.5 %). Coccidial prevalence was found to be 53.61 % in unorganized (backyard poultry birds) as compared to organized birds (25.55 %). Maximum positive cases of coccidian infection was found in monsoon season (60.55 %) and least in summer season (21.66 %). Birds of age 31–45 days showed more prevalence percentage (58.86 %). Higher oocysts count was recorded from July to September with a peak value (38973.00 ± 3075.6) in July and lowest (12914.00 ± 595.48) in the month of May.

Momin *et al.*, (2014). The present study was undertaken in different areas of Tangail district to investigate the presence of haemosporidian parasites in domestic poultry (Chicken, duck and pigeon). A total of 72 samples were examined from December, 2013 to May, 2014. Microscopical examinations of peripheral blood were performed. Among the examined samples, 33(45.8%) poultry were found to be infected with different blood protozoa. Two species of blood protozoa were identified such as *Leucocytozoon* spp. in chickens (34.6%) and ducks (58.3%); *Haemoproteus* spp. (22.7%) and *Leucocytozoon* spp. (22.7%) in pigeons. Female (46.5%) were 1.10 times more susceptible than male (44.8%) which was statistically significant.

Iqbal and Begum (2010). A study was conducted to assess the prevalence of coccidiosis in broiler of Bangladesh. Data were obtained by direct farm visit during July 2007 to June 2008 in the Sylhet district of Bangladesh. In the present study, general prevalence of coccidiosis in broiler was found 36%. Month wise highest prevalence was observed in March (56%) and lowest prevalence in the month of November (1%). Season wise prevalence showed the highest prevalence in the summer (42%) and the least in the autumn (10%). The age wise prevalence was highest in the 15-21 days age group (52%) and the least in 0-7 days (2%) age group of broiler. The highest prevalence (50%) of coccidiosis in the farm of mud type floor was found than that of concrete type floor (15%).

2.6 Effects of commercial drugs on chicken diseases

Islam *et al.*, (2021) determined the overall disease prevalence, prescription patterns, and disease associated factors in different bird types. Data were obtained through interviews and inspections and then stored in MS Excel 2010. Data were coded, recorded, and checked for consistency before exporting to STATA-13 software for statistical analysis. ArcGIS Desktop Version 10.4.1 was used to produce a map showing geographical case distribution. In total, 552 cases (182 exotic broilers, 118 Sonali, and 252 exotic layers) were included during the study period. Visceral gout (42.4%), coccidiosis (49.2%), and colibacillosis (24.2%) were the most frequent disease in broiler, Sonali, and layers, respectively. The study also showed the single application of watch group antibiotics was the highest in broilers (88.3%), followed by Sonali (67.4%) and layers (56.5%). Doxycycline (72.7%) was the most common antibiotic for treating visceral gout in broilers, whereas ciprofloxacin was highly used in Sonali for infectious bursal disease (84.4%), and coccidiosis (58.6%) respectively, and tiamulin (6.4%) for salmonellosis in layers. Antibiotics should be used more judiciously to curb the growing multidrug resistance pattern among zoonotic bacteria.

Haque *et al.*, (2020) Studied antibiotic-free broiler meat production is becoming increasingly popular worldwide due to consumer perception that it is superior to conventional broiler meat. Globally, broiler farming impacts the income generation of low-income households, helping to alleviate poverty and secure food in the countryside and in semi-municipal societies. However, there are many challenges that need to be overcome by adopting suitable strategies to produce antibiotic-free broiler meat with regards to food safety and chicken welfare issues.

El-Sawah *et al.*, (2020). The study was conducted to investigate the combination of a probiotic strain of *Enterococcus faecium* and diclazuril to control coccidiosis in broilers. A total of 240 one-day-old female broiler chicks were divided into eight groups (30 chicks per group): prophylactic groups (G1, G2 and G3) and therapeutic groups (G4, G5 and G6) and two control groups (untreated infected, G7 and untreated uninfected, G8 controls). In the prophylactic approach, diclazuril alone (G1), probiotic alone (G2) or a mixture of both probiotic and diclazuril (G3) was orally administered to the chicks via drinking water 10 days prior to the infection. However, in the therapeutic approach, G4, G5 and G6 birds were administered diclazuril alone, probiotic alone and diclazuril+probiotic mix, respectively, in drinking water for five consecutive days after the appearance of clinical signs of coccidiosis. Birds of both approaches and G7 were experimentally infected with 25×10^3 *Eimeria*-sporulated oocysts.

Khan *et al.*, (2019) In terms of adding extra antibiotics in feed, 32.5% of the sellers depended on feed sellers and only 20% of them used prescription provided by the registered veterinarian. The residue of ampicillin, ciprofloxacin and enrofloxacin in liver and meat of broilers were evaluated by using thin layer chromatography (TLC). The highest percentages of antibiotic residues were detected in the birds of Kachijhuli bazar (26.67%) and lowest in Shankipara bazar (13.33%). The highest percentages of antibiotics used in poultry feed was enrofloxacin (46.67%) followed by ciprofloxacin (30.00%) and amoxicillin (23.33%). In addition, amoxicillin plus ciprofloxacin (30%) and ciprofloxacin plus enrofloxacin (43.33%) were commonly found in the liver of broilers. All the broilers had antibiotic residue in their liver and breast meat containing antibiotic residues in 20% cases. Amoxicillin, ciprofloxacin and enrofloxacin were routinely used in poultry feed and the meat sellers had little knowledge about the indiscriminate use of antibiotics in poultry sector.

Rahman *et al.*, (2019) diagnosed diseases based on clinical history, clinical signs, and observable post-mortem lesions by the registered veterinarian or intern veterinarian. The most prevalent diseases in chickens were infectious bursal disease (IBD) (31.7%; CI (confidence interval) 24.7–39.3%), coccidiosis (22.8%; CI 16.6–29.8%), Newcastle disease (ND) (21.6%; CI 15.5–28.5%), and coli-enteritis (8.4%; CI 4.6–13.6%). The most prevalent disease in ducks was duck plague (DP) (76.6%; CI 52.8–91.7%). Newcastle disease was most prevalent (66.7%; CI 34.8–90.0%) in pigeons. Infectious bursal disease, aspergillosis, and colibacillosis respectively were seen in a higher proportion of cases in broiler chickens than in layer chickens (58.7%, 12.5%, and 11.2% vs. 6.9%, 1.1%, and 3.4%; $p \leq 0.05$).

Contrarily, ND was seen in greater proportion of cases in layer chickens (32.1%) than in broiler chickens (10.0%) ($p < 0.001$). Infectious bursal disease, ND, coccidiosis, and aspergillosis were higher in older age broilers than in younger broilers ($p \leq 0.05$). Antibiotics were often used to treat the poultry diseases such as trimethoprim with sulpha drugs (41%), ciprofloxacin (39%), sulphadiazine (27.5%), and erythromycin (26%). Through the present study, we can see how a passive surveillance system would be an effective tool for delineating disease distributions and common treatment regimens, thus helping to mitigate disease prevalence.

Sharma *et al.*, (2018). Inclusion Body Hepatitis (IBH) is viral disease of Avian Adenoviruses group and mostly affects avian species. Incidences of Adenovirus infection is gradually increases in most of the countries and many infections are in subclinical form. Mostly after the declining of maternal immunity in chicks, virus replicates in birds and make them prone to infections. IBH Infection in birds is characterized by haemorrhages and dystrophic necrobiotic changes in the liver and kidneys, accompanied by intranuclear inclusion bodies.

Matin *et al.*, (2017) was conducted for determination of the prevalence of colibacillosis in chicken in poultry farms in Mymensingh and Tangail districts. Isolation, identification, and antibiogram profile of *Escherichia coli* were also performed. A total of 25 chickens manifested clinical signs of colibacillosis were collected from five different poultry farms during natural outbreaks. In broiler, the prevalence of colibacillosis was 0.84%, and in layer, prevalence was 0.80%. The prevalence of colibacillosis was 1.0% and 0.5% in 25-30 days old and 31-35 days old broiler, respectively. In case of layer birds, the prevalence was 0.6% in 40-45 days old bird and 1% in 46-50 days old bird. Identity of the *E. coli* isolate of chicken was confirmed by sugar fermentation, biochemical tests, and polymerase chain reaction assay. Antibiogram profile of *E. coli* isolate of chicken revealed that it was multidrug resistant (resistant against two antibiotics, such as ampicillin and cefalexin). Data of this study suggest that colibacillosis is prevalent in the study areas which underscore the need of implementation of prevention and control measure against this disease.

Mohammed Shaheen and El-Far (2013). Modification of the curative efficiency of one or both of the administered drugs and minimized the drug resistance to take place through antimicrobial combination. In this study, the potential interaction effects of pefloxacin and florfenicol and their efficiencies were inspected on experimentally challenged broilers by *Escherichia coli* (*E. coli*) at 23 days of age. Challenged broilers were treated either by

pefloxacin (10 mg kg⁻¹) or florfenicol (30 mg kg⁻¹) orally, once per day for 5 successive days. Their combinations of either the recommended or half-therapeutic doses. Blood sampling (n=5) was collected from all groups at 2nd, 4th and 5th days during the treatment course and at 7th and 14th days post treatment. The obtained results revealed that pefloxacin and florfenicol combination minimized the severity of clinical signs due to *E. coli* infection. The drug combination of the recommended dose induced a significant.

Chandrakar *et al.*, (2012). The present investigation was carried out on one hundred twenty five day-old broiler chicks divided into five equal groups. The birds of group 1 served as negative control. The birds of group 2 were given Nutrigrow @ 5 g/100 chicks/day for 10 days followed by Protoface @ 20 g/1000 chicks/day from 11th to 20th day of age along with normal feed and from 21st day they were given Profitaze @ 50 g/1000 birds in evening water. After challenge, the chicks were given Protoface @ 200 g/1000 birds per day in water for 7 days. The birds of group 3 were given Protoface only before infection. The birds of group 4 were given Protoface @ 200 g/1000 chicks/day only after infection. The birds of group 5 were kept as positive control. The mortality rate of group 2 was lowest i.e. 16% whereas that of group 5 was 56%.

Conway *et al.*, (2001). Two 42-d floor pen studies were conducted with commercial broiler chickens to measure the efficacy of 1 ppm diclazuril in the starter or grower diet in shuttle programs with 66 ppm salinomycin. Study 1 compared a salinomycin to diclazuril (starter to grower diet) shuttle treatment with salinomycin to salinomycin, salinomycin to 100 ppm monensin, salinomycin to 99.8 ppm lasalocid, and unmedicated treatments. Study 2 compared a diclazuril to salinomycin (starter to grower) shuttle treatment with 125 ppm nicarbazin to salinomycin, 79.2 ppm narasin + nicarbazin to salinomycin, 125 ppm zoalene to salinomycin, and unmedicated treatments. Fifty 1-d-old chicks were randomly allotted to each of 10 pens per treatment in each study using a randomized complete block design. Starter (Days 0 to 21) and grower (Days 22 to 37) diets in each study contained 55 ppm bacitracin methylene disalicylate. The finisher diet (Days 38 to 42) in each study was unmedicated. Birds were inoculated via their feed on Day 22 (Study 1) or Day 15 (Study 2) with a mixed inoculum of *Eimeria acervulina*, *Eimeria maxima*, and *Eimeria tenella*.

CHAPTER III

MATERIALS AND METHODS

The experiment was carried out to investigate the overall prevalence of diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh.

3.1 Study Area

The study was conducted at upazila livestock office and different poultry farm at Mithapukur upazila in Rangpur of Bangladesh for diagnosis of disease.

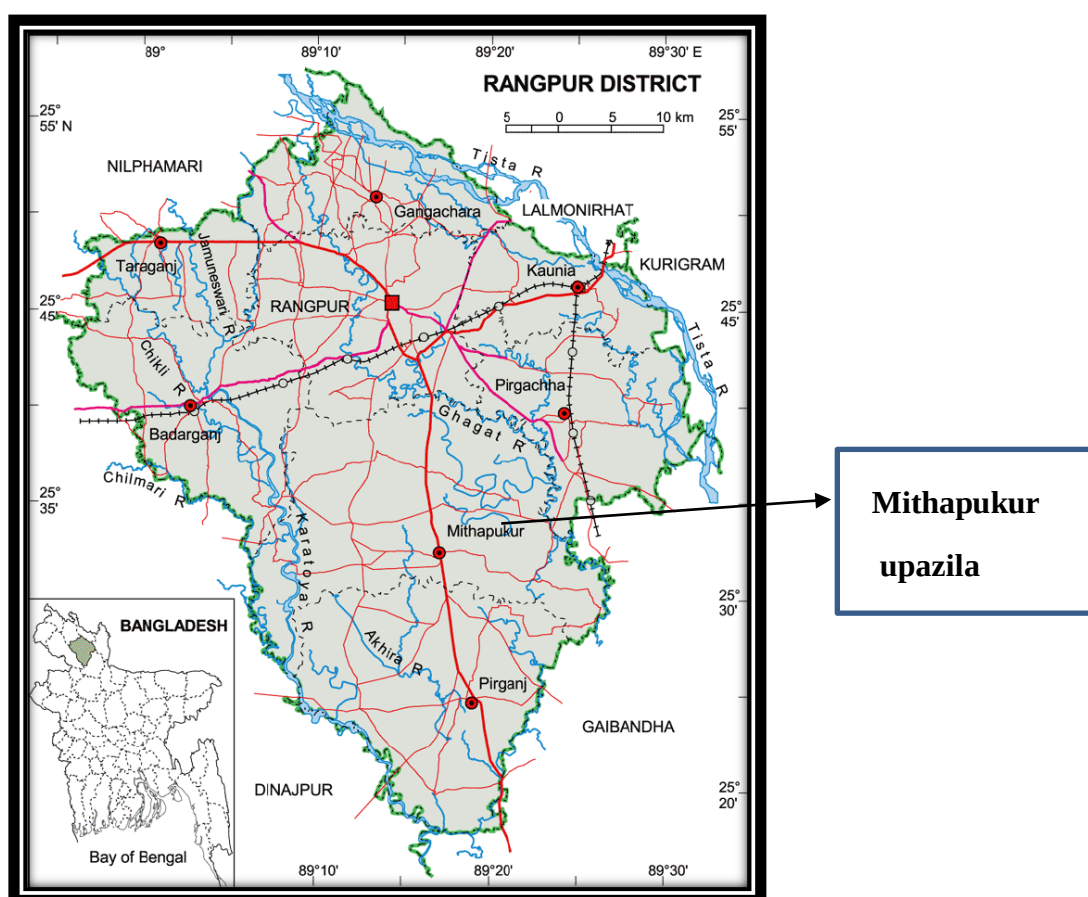


Figure 1: Map showing location of study area at Mithapukur upazila in Rangpur district.

3.2 Study Period

The study was conducted for a period of six months from November 2022 to April 2023. The information was collected from the farm owners through a standard questionnaire.

3.3 Study Population

A total 870 chicken (clinically ill and dead cases) were used for the study. Among them 308 were broilers, 270 were sonali and 292 were layer chicken.

3.4 Study design

Diseases were diagnosed through clinical signs and pathognomonic lesions. Clinical and epidemiological data were recorded. Clinical and post-mortem (PM) examinations were conducted for each case. Findings from each case were recorded in a structured record-keeping sheet. Data included farmers' education and experience, poultry species, production type (broiler/Sonali/layer), farm's location, farm size, floor type, birds' age, clinical history, clinical signs, morbidity and mortality, observable post-mortem findings, tentative diagnosis, and prescribed drugs (Hannan *et al.*, 2020). Antibiotic prescription data was also included in this study.

3.4.1 History

A history of suspected flocks from the villagers such as size of the flock, age, sex, breeds, vaccination, morbidity, mortality, litter used, proper ventilation, biosecurity, different clinical signs and symptoms, recent disease occurrence and other management programs were recorded.

3.4.2 Clinical findings

The general health condition and age of the chicken were recorded. The chickens were observed to detect clinical signs. The clinical signs were observed from the visual examination. The physical visit of the affected flocks and farmer's complaints about the affected birds were also considered.

3.4.3 Necropsy findings

A standard procedure was followed for necropsy findings (Meredith *et al.*, 2001).

- ❖ The feathers were wet down with a disinfectant solution to limit the distribution of feathers during the dissection.
- ❖ The birds were placed on its back with its feet towards me.
- ❖ Both legs were grasped and pushed down and away from the pelvis to loosen the joints.
- ❖ The skin was tent over the abdomen and cut with scissors.

- ❖ The skin was removed overlying the abdomen and breast (from neck to cloaca).
- ❖ The breast muscle was examined for decreased muscle mass, paleness (anemia), or bruising.
- ❖ The abdominal muscle was incised and cut through the ribs on the sides of the keel bone.
- ❖ The keel was grasped near the abdomen and pulled upwards to expose the internal organs and chest cavity.
- ❖ The liver was examined for changes in size or discoloration, white or yellow spots, abscesses, and tumors.
- ❖ The air sacs were examined for increased thickness and increased cloudiness. The normal air sac surface looks like soap bubbles or clear cellophane wraps.
- ❖ The gastrointestinal tract was cut between the esophagus and proventriculus.
- ❖ The proventriculus, gizzard, small intestines, large intestine, ceca were removed and cut off at the level of the cloaca. The pancreas will also be removed. It is the pinkish tan organ cradled within the loop of duodenum (a section of the small intestine).
- ❖ All attachments close to the intestines were cut off and the GI tract was set aside. At the end of the necropsy, this organ was opened up and examined for the internal parasite.
- ❖ Next the liver and spleen were removed. A green discoloration of the liver near the gall bladder was a normal finding. The spleen was reddish, round organ located at the junction of proventriculus and gizzard.
- ❖ Now the organs located near the backbone of the carcass were observed.
- ❖ The kidneys, which are elongated, lobulated organs that are embedded in the backbone of the birds, and the left ovary/oviduct (or paired testicles), which are positioned on the top of the kidneys were examined.
- ❖ The lung, which was attached to the ribs, was gently teased out of the ribcage for further examination.
- ❖ The outer surface of the heart was examined for a cloudy, thickened appearance, suggesting pericarditis. Excessive fluid which was located between the heart and pericardium (membranous covering of the heart) was also noted.
- ❖ Next the birds were turned around to face you and cut through the corner of the beak.
- ❖ The cut was extended through the throat and down towards the heart.

- ❖ The interior surface of the esophagus and crop was examined. The process of food and /or parasites (worms) in the crop was checked. Next cut through larynx, trachea, and syrinx was done. The inside surface was free of excess mucus.
- ❖ The birds were turned back to the previous positioning feet in front of you.
- ❖ The sciatic nerve located on the interior upper thigh (located under muscle) was exposed on both legs. The nerves were same size bilaterally with no swellings. With a sharp knife, cutting was done through the stifle and hock joints, looking for yellow or white pus like materials, blood, or excess fluid. Joints were appearing shiny and white with just a small amount of clear sticky fluid inside.
- ❖ To find the bursa of fabricius, the cloaca was cut and looked for a grape like structure towards the rear of the bird. The older the bird the smaller the bursa. The bursa was diminished in size reaches sexual maturity.
- ❖ The bursa was cut in half. Wrinkles running parallel to each other on the surface were noted and also cream colored in appearance and any discoloration or swelling was noted.
- ❖ Now returned to the GI tract and was started with the proventriculus, and cut lengthwise. The inside wall was bumpy and this was normal as these were digestive glands.
- ❖ The gizzard, intestine, and ceca were cut. The appearance of the inside walls (mucosa) and the presence of parasites (worms), blood, and/or thickened or discolored surfaces were noted.
- ❖ The carcass was disposed properly and disinfected surfaces and tools.

3.5 Clinical Signs of different diseases of commercial chicken

3.5.1 New Castle Disease

Onset is rapid, and signs appear throughout the flock within 2–12 days (average 5) after aerosol exposure. Respiratory signs of gasping, coughing, sneezing, and rales predominate in infections with NDV. Nervous signs of tremors, paralyzed wings and legs, twisted necks, circling, clonic spasms, and complete paralysis may accompany, but usually follow, the respiratory signs in neurotropic velogenic disease. Respiratory signs with depression, watery greenish diarrhea, and swelling of the tissues of the head and neck are typical of the most virulent form of the disease, viscerotropic velogenic Newcastle disease, although nervous signs are often seen, especially in vaccinated poultry. Varying degrees of depression and in-appetence are seen. Partial or complete cessation of egg production may occur. Eggs may be abnormal in color, shape, or surface and have

watery albumen. Mortality is variable but can be as high as 100% with NDV infections. Well-vaccinated birds may not show any signs of being infected except for a decrease in egg production, but these birds will shed virus in saliva and feces. Poorly vaccinated birds may develop torticollis, ataxia, or body and head tremors 10–14 days after infection and may recover with supportive care.

3.5.2 Infectious Bursal Disease/Gumboro

In clinical infections, onset of the disease occurs after an incubation of 3–4 days. Chickens may exhibit severe prostration, incoordination, watery diarrhea, soiled vent feathers, vent picking, and inflammation of the cloaca. Flock morbidity is typically 100%, and mortality can range from 5%–20%. Recovery occurs in <1 wk, and sonali chicken's weight gain is delayed by 3–5 days. The presence of maternal antibody will modify the clinical course of the disease.

3.5.3 Infectious Bronchitis

Coughing, sneezing, and have tracheal rales for 10–14 days. Conjunctivitis and dyspnea were seen, and sometimes facial swelling, particularly with concurrent bacterial infection of the sinuses. Chicks appeared depressed and huddle under heat lamps. Feed consumption and weight gain are reduced. Infection with nephron-pathogenic strains caused initial respiratory signs, then later depression, ruffled feathers, wet droppings, greater water intake, and death. In layers, egg production dropped by as much as 70%, and eggs are often misshapen, with thin, soft, rough, and/or pale shells, and can be smaller and have watery albumen. In most cases, egg production and egg quality returned to normal, but this may take up to 8 wk. In most outbreaks mortality is 5%, although mortality rates are higher when disease is complicated by concurrent bacterial infection. Nephro-pathogenic strains can induce interstitial nephritis with high mortality (up to 60%) in young chicks. Infection of young chicks may cause permanent damage to the oviduct, resulting in layers or breeders that never reach normal levels of production

3.5.4 Inclusion Body Hepatitis

Flocks affected with IBH/HHS often have abrupt onset of mortality, and individual chickens may show nonspecific clinical signs such as lethargy huddling, ruffled feathers, and yellow, mucoid droppings due to excess bile acids. Mortality usually lasts for 5 days in IBH and longer in HHS.

3.5.5 Salmonellosis

The disease is seen in all age groups, but birds <4 wk old are most commonly affected. Birds are found dead in the hatchery shortly after hatching. Affected birds huddle near a heat source, are anorectic, appear weak, and have whitish fecal pasting around the vent (diarrhea). Survivors are

small in size and frequently become asymptomatic carriers with localized infection of the ovary. Some of the eggs laid by such hens hatch and produce infected progeny.

3.5.6 Pasteurellosis

The sudden and unexpected death could be the first sign of the disease. In chronic fowl cholera, signs and Lesions are generally related to localized infections of the sternal bursae, wattles, joints, tendon sheaths, and footpads, which often are swollen because of accumulated fibrinosuppurative exudate. Commonly observed signs are anorexia, ruffled feathers, oral and nasal mucus discharge, cyanosis and white or greenish watery mucoïd diarrhoea. There may be exudative conjunctivitis and pharyngitis. Torticollis may result when the meninges, middle ear, or cranial bones are infected.

3.5.7 Colibacillosis

The birds affected with colibacillosis shown clinical signs of low performance in older birds (due to tumors), high mortality in younger birds (due to yolk-sac infections), high embryonic mortality in breeder flocks, respiratory distress diarrhoea respiratory signs, coughing, sneezing, snick, defection, reduced appetite, poor growth, omphalitis. Signs are nonspecific and vary with age, organs involved, and concurrent disease. Young birds dying of acute septicemia have few lesions except for an enlarged, hyperemic liver and spleen with increased fluid in body cavities.

3.5.8 Chronic Respiratory Disease

The birds affected with chronic respiratory disease shown clinical signs of coughing, nasal and ocular discharge, poor productivity, slow growth, leg problems, stunting, inappetance, reduced hatchability and chick viability, occasional encephalopathy and abnormal feathers, tail bobbing when breathing, emaciation, rales, and sneezing, open mouth breathing, poor growth, decreased feed consumption, lowered egg production and shell quality.

3.5.9 Coccidiosis

Coccidiosis affected birds shown clinical signs of depression, ruffled feathers, closed eyes, inappetance, diarrhoea, blood in faeces, production less affected than in some of the other forms of coccidiosis. Signs of coccidiosis range from decreased growth rate to a high percentage of visibly sick birds, severe diarrhoea, and high mortality. Feed and water consumption are depressed. Weight loss, development of culls, decreased egg production, and increased mortality may accompany outbreaks.

3.6 Post Mortem Report

All post mortem lesions of chicken diseases those caused mortality were studied according to the causal agent described in below:

3.6.1 Newcastle Disease

Remarkable gross lesions are usually seen only with viscerotropic velogenic Newcastle disease. Petechiae may be seen on the serous membranes; hemorrhages of the proventricular mucosa and intestinal serosa are accompanied by multifocal, necrotic hemorrhagic areas on the mucosal surface of the intestine, especially at lymphoid foci such as cecal tonsils. Splenic necrosis and hemorrhage and edema around the thymus may also be seen. In contrast, lesions in birds infected with NDV strains may be limited to congestion and mucoid exudates seen in the respiratory tract with opacity and thickening of the air sacs. Secondary bacterial infections increase the severity of respiratory lesions.

3.6.2 Infectious Bursal disease

Swelling of the Bursa of Fabricius, edematous, yellowish, and occasionally hemorrhagic, especially in birds that died of the disease. Strains of vvIBDV cause similar cloacal bursa lesions, and congestion and hemorrhage of the pectoral and leg muscles can also occur. IBDV strains that cause subclinical disease (sometimes referred to as variant strains) cause atrophy of the cloacal bursa without inflammation. Chickens that have recovered from IBDV infections have small, atrophied, cloacal bursas due to the destruction and lack of regeneration of the bursal follicles.

3.6.3 Infectious Bronchitis

In the respiratory tract, the trachea, sinuses, and nasal passages contain serous, catarrhal, or caseous exudates, and the air sacs a foamy exudate initially, progressing to cloudy thickening. If complicated by infection with *E. coli*, there may be caseous airsacculitis, perihepatitis, and pericarditis. Birds infected when very young may have cystic oviducts, whereas those infected while in lay have an oviduct of reduced weight and length and regression of the ovaries. Infection with nephropathogenic strains results in swollen, pale kidneys, with the tubules and ureters distended with urates; in birds with urolithiasis, distended ureters with urates and contain uroliths, and the kidneys become atrophied.

3.6.4 Inclusion Body Hepatitis (IBH)

Liver swollen, yellow, mottled with petechiae and ecchymoses. Kidneys and bone marrow pale. Blood thin. Bursa and spleen small. Microscopically - basophilic intranuclear inclusions.

3.6.5 Salmonellosis

Liver become enlarged, congested with haemorrhage, Grayish white necrotic foci in the heart and lungs discolored, misshapen haemorrhagic cystic ova found in the ovary, Unabsorbed yolk contain cheesy to blood stain fluid. Intestine typically contains viscous slimy, bile stained materials.

3.6.6 Pasteurellosis

Caseous exudate in wattles, sinuses, the nasal turbinates, middle ear, joints or tendon sheaths. Petechial and ecchymotic haemorrhages on the heart, serous and mucous membranes, on the gizzard and abdominal fat. The liver is swollen and is streaked with white areas and associated small grey areas of necrosis. Free yolk in the peritoneal cavity in breeder hens and layers. Acute oophoritis and peritonitis are often seen. The lining of the upper intestine is reddened and gut content is slimy. In chronic cases Darkened breast muscle is frequently noted and haemorrhagic lesions are often missing.

3.6.7 Colibacillosis

Air sac become cloudy and thicken Fibrinous pericardium and perihepatitis presence of unabsorbed yolk. Yolk sac membrane become thicken due to congestion and exudation, Enlargement of liver with bile staining, enlargement of spleen presence of white pseudo membrane over the pericardium, Presence of small nodules in the intestinal tract, mesentery and liver. Birds that survive septicemia develop subacute fibrinopurulent airsacculitis, pericarditis, perihepatitis, and lymphocytic depletion of the bursa and thymus (unusually pathogenic salmonellae produce similar lesions in chicks). Although airsacculitis is a classic lesion of colibacillosis, it is unclear whether it results from primary respiratory exposure or from extension of sepsitis. Sporadic lesions include pneumonia, arthritis, osteomyelitis, peritonitis, and salpingitis.

3.6.8 Chronic respiratory disease (CRD)

The chicken died at piping stage – cheesy materials in air sac, in acute stage: Inflammation of the trachea with excess mucous, air sac become cloudy contain cheesy materials in chronic stage. The air sac become thickened and containing mucopurulent exudate. Lungs become severely dark spotted,

Deposition of cream color fibrin layer on the surface of liver, heart and also on abdomen with perihepatitis and pericarditis.

3.6.9 Coccidiosis

Haemorrhage in the caeca with white spot Haemorrhage in the small intestine, thicken intestinal wall
Coagulative necrosis in lower intestine Watery exudates, white transverse band in upper small intestine.



Image 1: Post mortem examination of bird at farm.



Image 2: Performing post-mortem in ULO office, Mithapukur, Rangpur.



Haemorrhages in
the thigh muscle

Image 3: Infectious Bursal Disease (Gumboro) in sonali chicken.

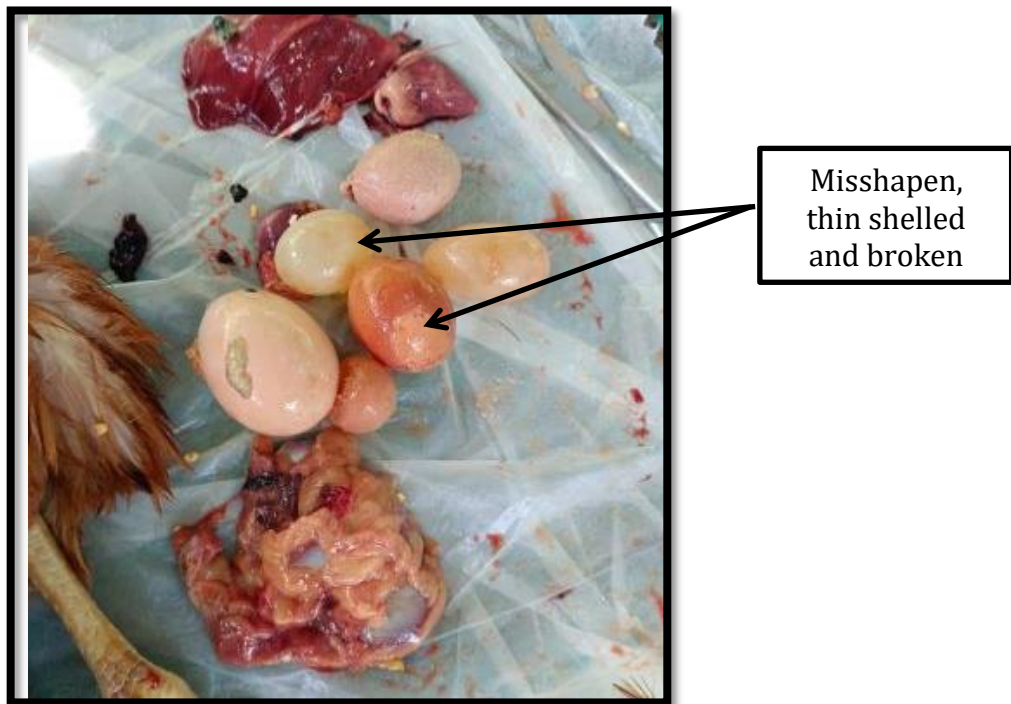


Image 4: Infectious Bronchitis in Layer chicken

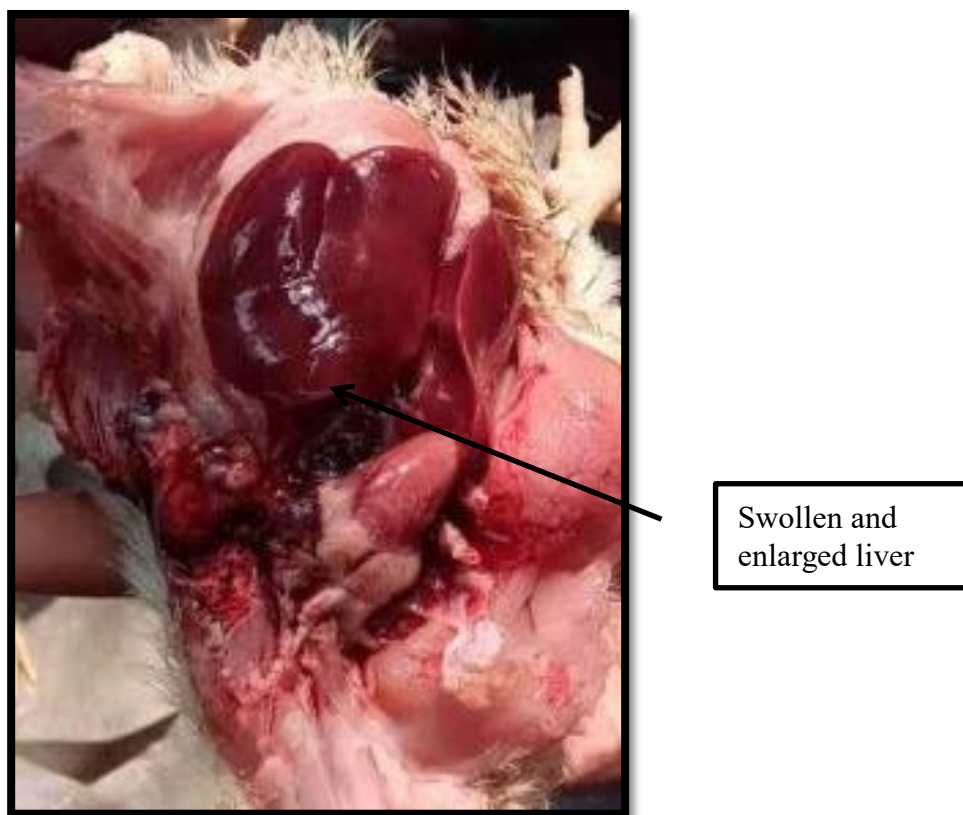
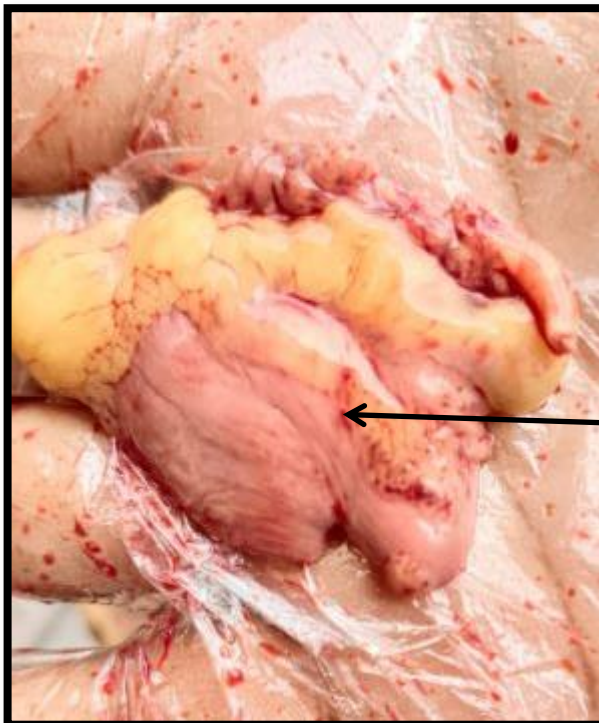


Image 5: Avian Leukosis in layer chicken.



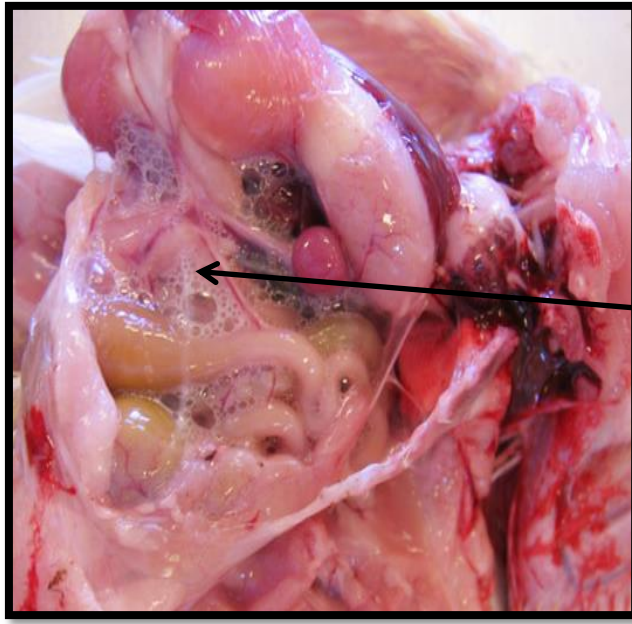
Bronze colour liver

Image 6: Avian Salmonellosis in layer chicken.



Hemorrhage
in the heart

Image 7: Fowl Cholera



Foamy exudate seen early in infection

Image 8: Colibacillosis in layer chicken



Chalky white deposits on pericardium

Image 9: Visceral gout

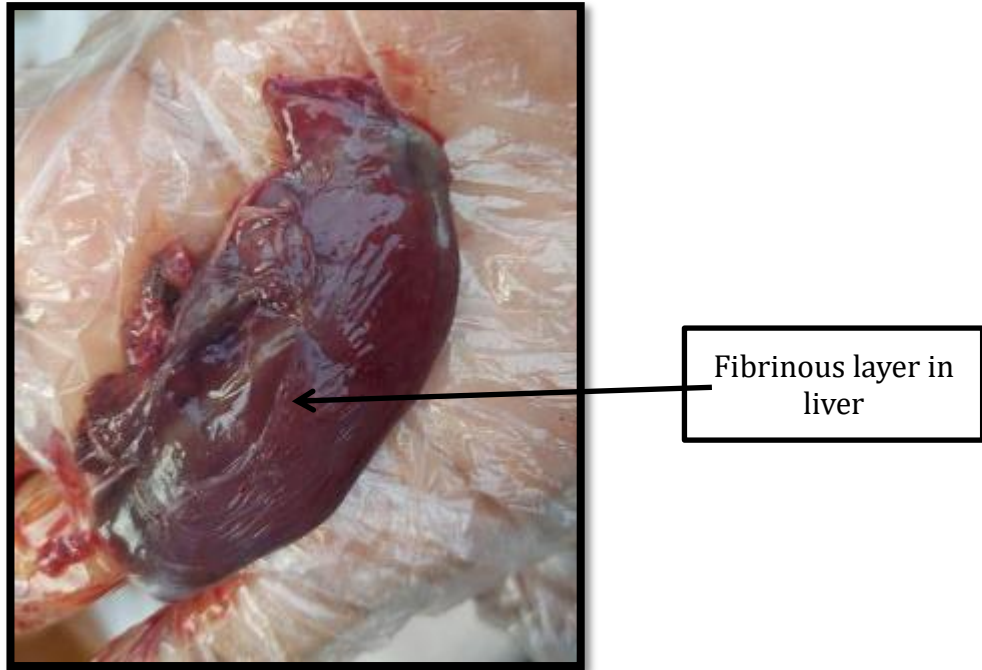


Image 10: Avian Mycoplasmosis

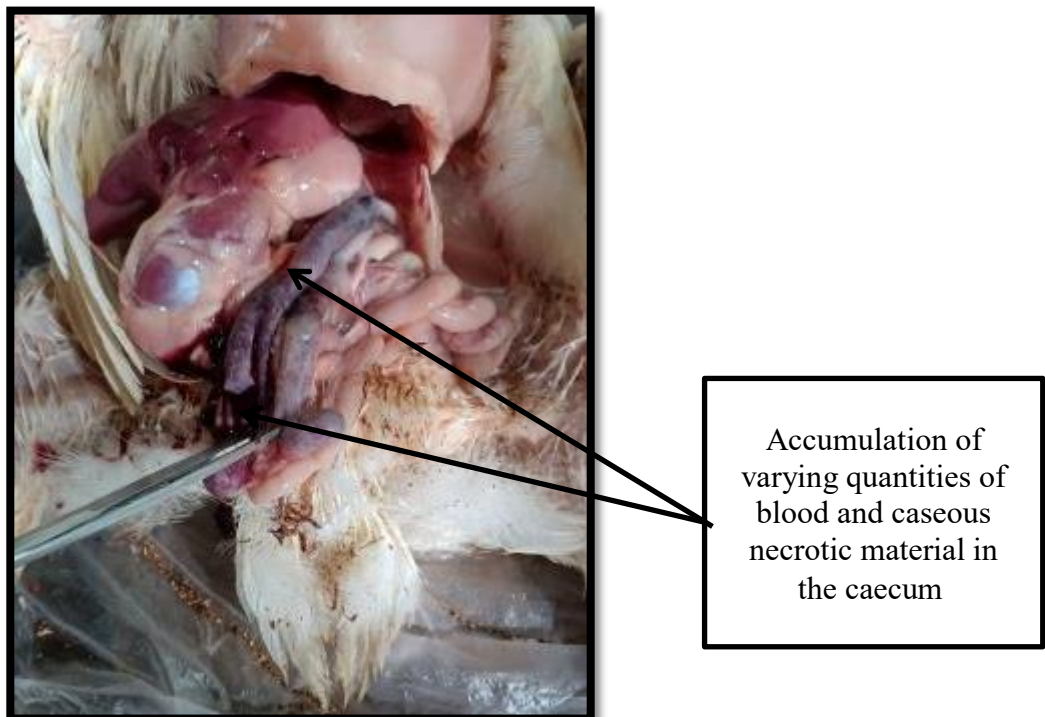


Image 11: Coccidiosis in sonali chicken.

CHAPTER IV

RESULTS

The research was conducted to observe the prevalence of diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh from November 2022 to April 2023. Total 870 clinically ill and dead chicken were taken for this study where 308 were broilers, 270 were Sonali and 292 were layer chicken.

4.1 Viral disease in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

Among 870 commercial chicken 308 were broiler chicken, 270 were sonali and 292 were layer. The overall prevalence of viral disease in broiler, sonali and layer chicken were 37.7%, 30.0% and 26.0% respectively. In broiler chicken the highest prevalence was seen in inclusion body hepatitis (18.5%) and lowest in infectious bronchitis (0.6%). In sonali chicken the highest prevalence was seen in infectious bursal disease (15.6%) and lowest in avian leucosis (0.4%). Highest prevalence in layer chicken was seen in Newcastle Disease (9.9%) and lowest in avian leucosis (1.4%) shown in table 1 and figure 2. The variations were statistically significant ($p < 0.05$).

Table 1. Viral disease in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

Disease	Broiler, n=308 (%)	Sonali, n=270 (%)	Layer, n=292 (%)	Level of significance
Infectious Bursal Disease	37 (12.0)	42 (15.6)	9 (3.1)	(0.03) *
Inclusion Body hepatitis	57 (18.5)	-	-	
Newcastle Disease	14 (4.5)	25 (9.3)	29 (9.9)	
Avian Influenza	6 (1.9)	8 (3.0)	13 (4.5)	
Avian Leucosis	-	1 (0.4)	4 (1.4)	
Infectious Bronchitis	2 (0.6)	5 (1.9)	16 (5.5)	
Marek's Disease	-	-	5 (1.7)	
Overall	116 (37.7)	81 (30.0)	76 (26.0)	

$P < 0.05$ means significant at 5% level of significance

* means Significant

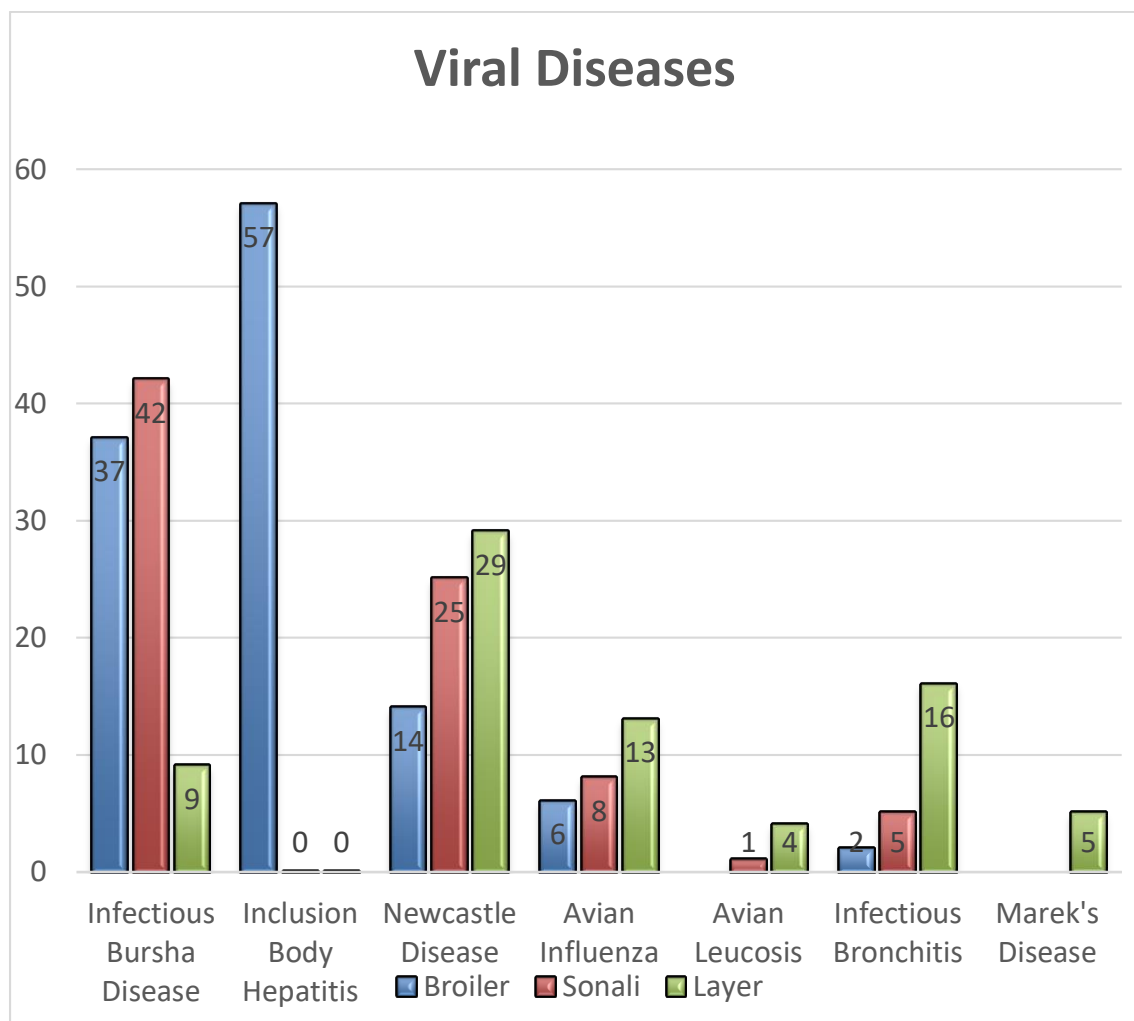


Figure 2: Viral disease in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

4.2 Bacterial diseases in commercial chicken Mithapukur upazila in Rangpur district of Bangladesh

The overall prevalence of bacterial disease in broiler, sonali and layer chicken were 20.1%, 15.6% and 42.8% respectively. In broiler chicken the highest prevalence was seen in colibacillosis (10.4%) and lowest in salmonellosis (3.9%). In sonali chicken the highest prevalence was also seen in colibacillosis (6.3%) and lowest in salmonellosis (4.1%). Highest prevalence in layer chicken was seen in colibacillosis (13.7%) and lowest in fowl cholera (4.1%) shown in table 2 and figure 3. The variations were statistically significant ($p < 0.05$).

Table 2. Bacterial diseases in commercial chicken Mithapukur upazila in Rangpur district of Bangladesh

Disease	Broiler, n=308 (%)	Sonali, n=270 (%)	Layer, n=292 (%)	Level of significance
Colibacillosis	32 (10.4)	17 (6.3)	40 (13.7)	(0.02) *
Salmonellosis	12 (3.9)	11 (4.1)	31 (10.6)	
Fowl Cholera	-	-	12 (4.1)	
Infectious Coryza	-	-	22 (7.5)	
Necrotic enteritis	18 (5.8)	14 (5.2)	20 (6.8)	
Total	62 (20.1)	42 (15.6)	125 (42.8)	

$P < 0.05$ means significant at 5% level of significance,

* means Significant

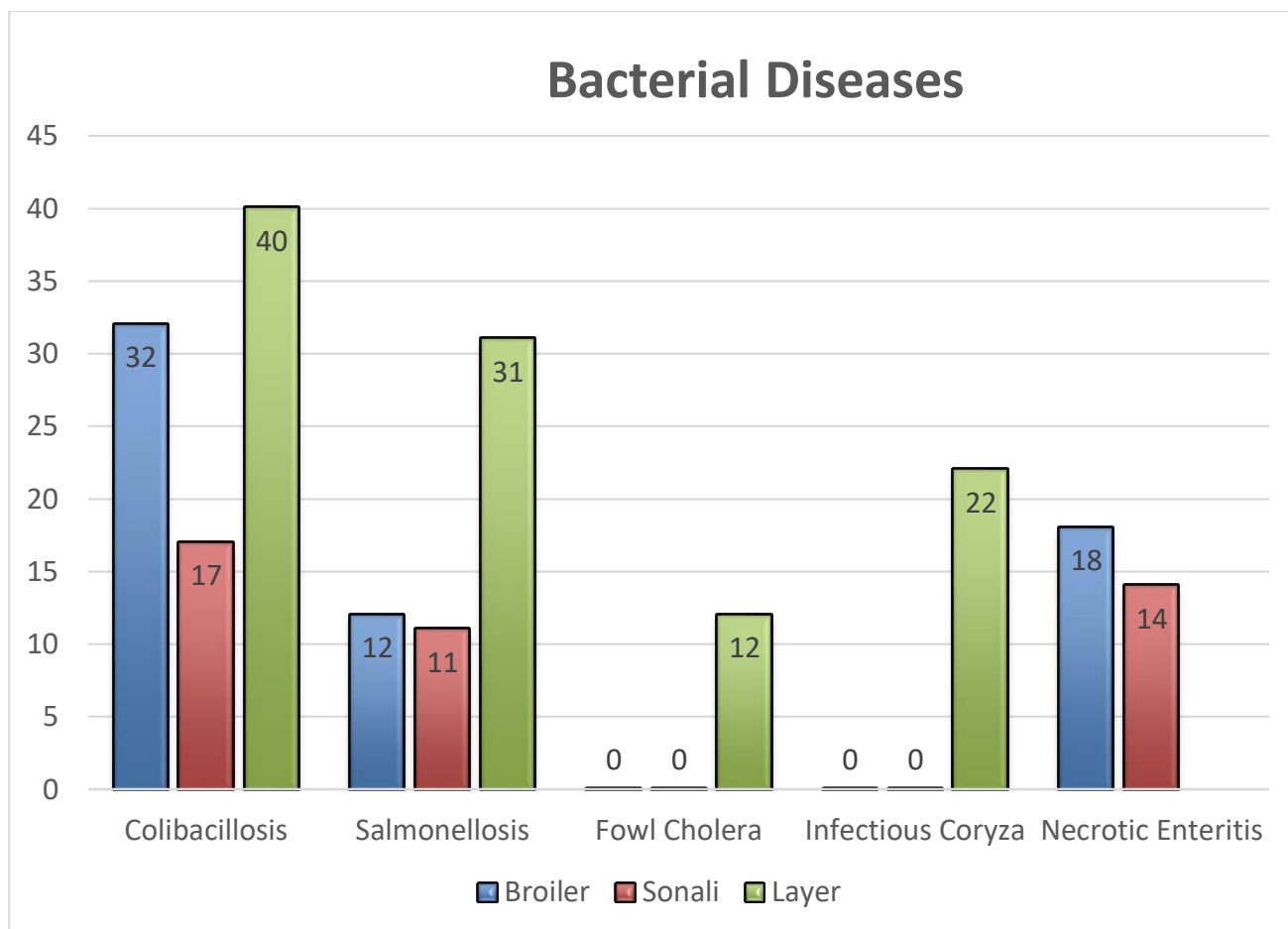


Figure 3: Bacterial diseases in commercial chicken Mithapukur upazila in Rangpur district of Bangladesh

4.3 Fungal, protozoan and other diseases and disease condition in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

Among fungal, protozoan and other diseases the overall prevalence of disease in broiler, sonali and layer chicken were 42.2%, 54.4% and 31.2% respectively. In broiler chicken the highest prevalence was seen in Mycoplasmosis (13.3%) and lowest in Aflatoxicosis (0.3%). In sonali chicken the highest prevalence was also seen in coccidiosis (32.6%) and lowest in Aspergillosis (0.7%). Highest prevalence in layer chicken was seen in Mycoplasmosis (12.7%) and lowest in Aspergillosis (0.7%) shown in table 3 and figure 4. The variations were statistically significant ($p < 0.05$).

Table 3: Fungal, protozoan and other diseases and disease condition in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

Disease	Broiler, n=308 (%)	Sonali, n=270 (%)	Layer, n=292 (%)	Level of significance
Aspergillosis	19 (6.2)	2 (0.7)	2 (0.7)	(0.05) *
Coccidiosis	3 (1.0)	88 (32.6)	6 (2.1)	
Aflatoxicosis	1 (0.3)	4 (1.5)	16 (5.5)	
Visceral gout	31 (10.0)	-	-	
Heat stress	22 (7.4)	11 (4.1)	15 (5.1)	
Ascites	10 (3.2)	-	-	
Cannibalism	-	15 (5.6)	9 (3.1)	
Nutritional disease	3 (0.9)	5 (1.9)	6 (2.1)	
Mycoplasmosis	41 (13.3)	22 (8.1)	37 (12.7)	
Total	130 (42.2)	147 (54.4)	91 (31.2)	

$P < 0.05$ means significant at 5% level of significance,

* means Significant

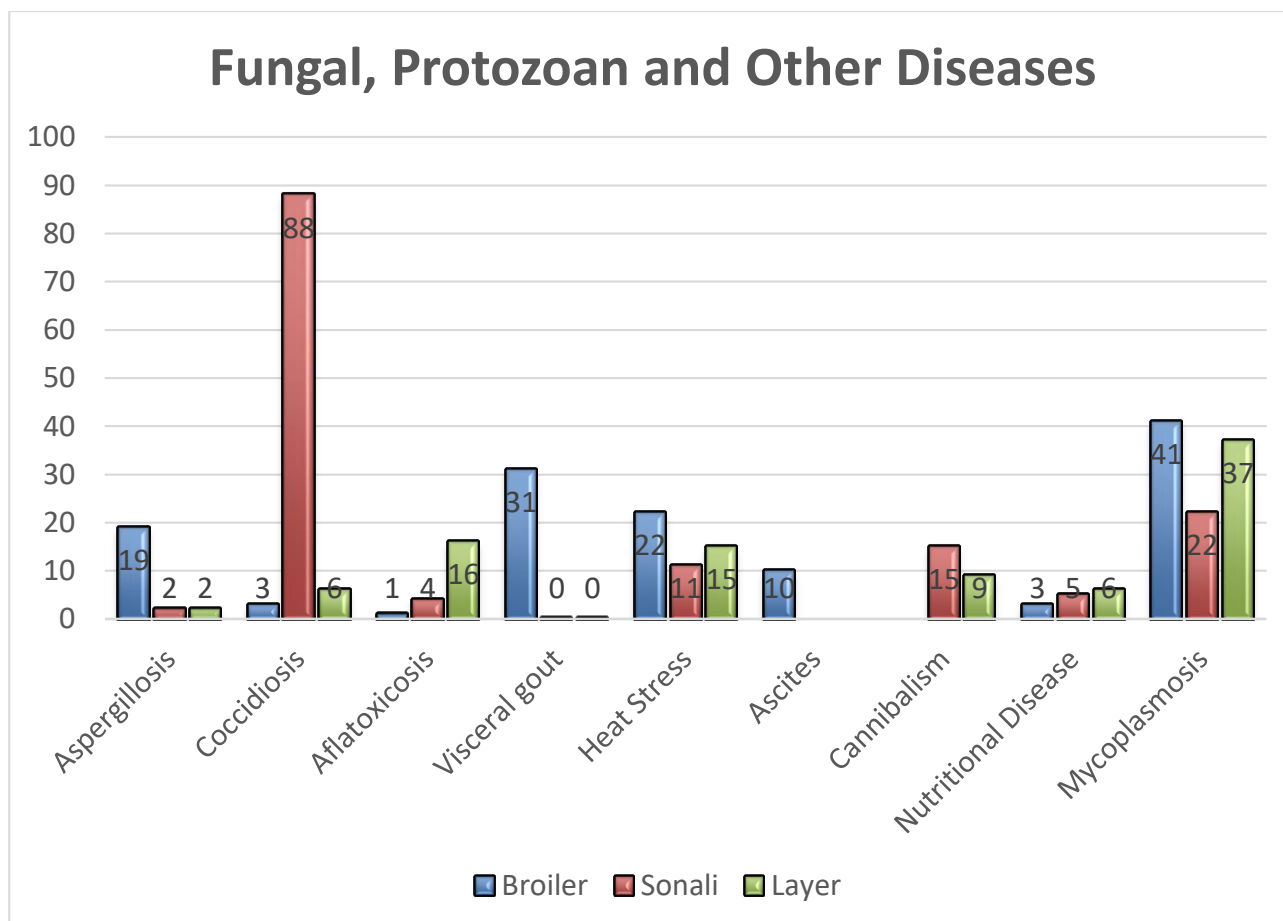


Figure 4. Fungal, protozoan and other diseases and disease condition in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

4.4 Age- wise prevalence of some predominant diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

The commercial chickens were divided into three different age groups. Among different disease Inclusion Body Hepatitis was more predominant in broiler chicken and 14-27 days old age group were more affected (63.2%) other age group. In case of sonali chicken coccidiosis was the predominant disease where 14-40 days' age group were more susceptible (60.2%) than other age group. Colibacillosis in layer chicken were more predominant and 101-above days age group showed highest prevalence (62.5%) rate than other age group shown in table 4. The variations were not statistically significant ($p>0.05$).

Table 4: Age- wise prevalence of some predominant diseases in commercial chicken in Rangpur district

Factor	Broiler		Sonali		Layer	
	Inclusion Body Hepatitis (57)		Coccidiosis (88)		Colibacillosis (40)	
	Categories	N (%)	Categories	N (%)	Categories	N (%)
Age (days)	3-13	13 (22.8)	3-13	-	2-13	-
	14-27	36 (63.2)	14-40	53 (60.2)	14-100	15 (37.5)
	28-40	6 (10.5)	41-56	35 (39.8)	101-above	25 (62.5)
Level of significance	NS (0.125)					

4.5 Flock size- wise prevalence of some predominant diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

The commercial chickens were divided into three different flock size. Inclusion Body Hepatitis (50.9%) in broiler chicken, coccidiosis (45.5%) in sonali chicken and colibacillosis (50.0%) in layer chicken were more affected in larger flock size of 1001-1500 shown in table 5. The variations were not statistically significant ($p>0.05$).

Table 5. Flock size- wise prevalence of some predominant diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

Factor	Broiler		Sonali		Layer	
	Inclusion Body Hepatitis (77)		Coccidiosis (88)		Colibacillosis (40)	
	Categories	N (%)	Categories	N (%)	Categories	N (%)
Flock size	100-500	11 (19.3)	100-500	13 (14.8)	100-500	7 (17.5)
	501-1000	17(29.8)	501-1000	35 (39.8)	501-1000	13 (32.5)
	1001-1500	29 (50.9)	1001-1500	40 (45.5)	1001-1500	20 (50.0)
Level of significance	NS (0.325)					

4.6 Floor type-wise prevalence of some important diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

The commercial chickens were reared in two different rearing system i.e. earthen system and paved system. All the three predominant disease in earthen system were higher in Inclusion Body Hepatitis (75.4%) in broiler chicken, coccidiosis (59.1%) in sonali chicken and colibacillosis (62.5%) in layer chicken shown in table 6. The variations were not statistically significant ($p>0.05$).

Table 6: Floor type-wise prevalence of some important diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

Factor	Broiler		Sonali		Layer	
	Inclusion Body Hepatitis (57)		Coccidiosis (88)		Colibacillosis (40)	
	Categories	N (%)	Categories	N (%)	Categories	N (%)
Floor type	Earthen	43 (75.4)	Earthen	52 (59.1)	Earthen	25 (62.5)
	Paved	14 (24.6)	Paved	36 (40.9)	Paved	15 (37.5)
Level of significance	NS (0.234)					

4.7 Education-wise prevalence of some important diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

The commercial chickens were reared in three different education groups i.e. primary, secondary and higher education. All the three predominant diseases at farm managed with people of primary education showed higher prevalence in Inclusion Body Hepatitis (52.6%) in broiler chicken, coccidiosis (62.5%) in sonali chicken and colibacillosis (62.5%) in layer chicken and moderate in farms managed with people of secondary education and lower with people reared with higher education shown in table 7. The variations were not statistically significant) $p > 0.05$).

Table 7: Education-wise prevalence of some important diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

Factor	Broiler		Sonali		Layer	
	Inclusion Body Hepatitis (57)		Coccidiosis (88)		Colibacillosis (40)	
	Categories	N (%)	Categories	N (%)	Categories	N (%)
Education	Primary	30 (52.6)	Primary	55 (62.5)	Primary	25 (62.5)
	Secondary	20 (35.1)	Secondary	23 (26.1)	Secondary	9 (22.5)
	Higher	7 (12.3)	Higher	10 (11.4)	Higher	6 (15.0)
Level of significance	NS (0.214)					

4.8 Effects of commercial drugs against Inclusion Body Hepatitis in broiler

Farms affected with inclusion body hepatitis were grouped into three treatment groups i. e. A, B and C and each group contain 500 chicken. All three groups are commonly treated with Liver tonic (Heparen/Neomeriol) @1ml/1L Drinking morning water daily for 5 days; Kidney tonic (Nephrocare/Lumix vet) @1ml/L drinking water noon water daily for 5 days; Vitamin-C (Rena C/Vita C) (Ascorbic Acid-98%) @ 1gm/3L drinking water at noon daily for 3 days; Immunomodulator (Xillian/AIB Vet) @ 1gm/3L drinking water evening daily for 5 days with a variation in the treatment in group A with Glucose + Sodium-bicarbonate @ 7+3gm/10L drinking morning water for 5 days; in group B with Molasses 5%@ 1gm/3L drinking water noon for 3 days and in group C with antibiotic Florfenicol (20%) @ 1ml/1L drinking water 16hrs daily for 3 days. Among all treatment, group A treatment group significantly reduces the disease within 5 ± 0.75 days than other treatment groups shown in table 8.

Table 8. Effects of commercial drugs against Inclusion Body Hepatitis in broiler

Name of the group	No. of Birds treated	Name of drugs	Dose & route of administration	Range of complete recovery (days)	Level of significance
Group A	500	a) Glucose + Sodium-bicarbonate b) Liver tonic (Heparen/Neomeriol) c) Kidney tonic (Nephrocare/Lumix vet) d) Vitamin-C (Rena C/Vita C) (Ascorbic Acid-98%) e) Immunomodulator (Xillian/AIB Vet)	a) 7+3gm/10L drinking morning water for 5 days b) 1ml/1L Drinking morning water daily for 5 days. c) 1ml/L drinking water noon water daily for 5 days d) 1gm/3L drinking water at noon daily for 3 days e) 1gm/3L drinking water evening daily for 5 days	5 ± 0.75 a	(0.04) *
Group B	500	a) Liver tonic b) Kidney tonic c) Vitamin-C (Ascorbic Acid-98%)	a) 1ml/1L Drinking water 12hrs daily for 5 days. b) 1gm/L drinking water morning daily for 5days c) 1ml/L drinking water morning daily for 5 days	7 ± 0.25 b	

		d) Molasses 5% e) Immunomodulator	d) 1gm/3L drinking water noon for 3 days e) 1gm/2L drinking water evening for 5 days	
Group- C	500	a) Florfenicol (20%) b) Liver tonic c) Kidney tonic d) Vitamin-C (Ascorbic Acid-98%) e) Immunomodulator	a) 1ml/1L drinking water 16hrs daily for 3 days. b) 1ml/L drinking water morning daily for 5 days c) 1ml/L drinking water morning daily for 5 days d) 1gm/5L drinking water 8hrs for 3 days e) 1gm/2L drinking water evening daily for 5 days	10±0.25 c

P<0.05 means statistically significant at 5% level of significance.

4.9 Effects of commercial drugs against coccidiosis in sonali chicken

Farms affected with coccidiosis were grouped into three treatment groups i. e. A, B and C and each group contain 500 chicken. All three groups are commonly treated with Vitamin-k (Rena K) @1gm/5L drinking water for 72 hrs; Vitamin-C (Vita C) (Ascorbic Acid-98%) @ 1gm/5L drinking water noon for 3 days; Kidney Tonic (Lumix vet) @ 1ml/L drinking water evening daily for 5 days; with a variation in the treatment in group A with Diclazuril (dmeria) (2.0%) @ 1ml/2L Drinking water 72hrs; in group B with Toltrazuril (2.5%) @ 1ml/2L Drinking water 5 days daily and in group C with Amprolium (20%) @ 2gm/L Drinking water daily for 5 days. Among all treatment, group A treatment group significantly reduces the disease within 3 ± 0.75 days than other treatment groups.

Table 9. Effects of commercial drugs against coccidiosis in sonali chicken

Name of the group	No. of Birds treated	Name of drugs	Dose & route of administration	Range of complete recovery (days)	Level of significance
Group A	500	a) Diclazuril (Dmeria) (2.0%) b) Vitamin-k (Rena K) c) Vitamin-C (Vita C) (Ascorbic Acid-98%) d) Kidney Tonic (Lumix vet)	a) 1ml/2L Drinking water 5 days daily b) 1gm/5L drinking water for 72 hrs c) 1gm/5L drinking water noon for 3 days d) 1ml/L drinking water evening daily for 5 days	3 ± 0.75 a	(0.04) *
Group B	500	a) Toltrazuril (2.5%) b) Vitamin-k (Rena K) c) Vitamin-C (Vita C) (Ascorbic Acid-98%) d) Kidney Tonic (Lumix vet)	a) 1ml/2L Drinking water 5 days daily b) 1gm/5L drinking water for 72 hrs c) 1gm/5L drinking water noon for 3 days d) 1ml/L drinking water evening daily for 5 days	5 ± 0.25 b	

Group-C	500	a) Amprolium (20%) b) Vitamin-k (Rena K) c) Vitamin-C (Vita C) (Ascorbic Acid-98%) d) Kidney Tonic (Lumix vet)	a) 2gm/L Drinking water daily for 5 days b) 1gm/5L drinking water for 72 hrs c) 1gm/5L drinking water noon for 3 days d) 1ml/L drinking water evening daily for 5 days	8±0.25 b	
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P<0.05 means statistically significant at 5% level of significance.

4.10 Effects of commercial drugs against Colibacillosis in layer

Farms affected with colibacillosis were grouped into three treatment groups i. e. A, B and C and each group contain 500 chicken. Group A treated a) Florfenicol @ 1ml/2L Drinking water twice daily for 5 days b) Neomycin Sulphate (Neo vet 70) @ 1gm/2L drinking water twice daily for 5 days c) Kidney Tonic (Nephrocare) @ 1ml/L drinking water Morning daily for 5 days d) Toxin Binder (AquaTox) @ 1ml/L water noon for 5 days and e) Vitamin E-Selenium (Sel E) @ 1ml/L drinking water evening for 5 days and Group B treated with a) Florfenicol(20%) @ 1ml/2L Drinking water twice daily for 5 days b) Amoxicillin (30%) @ 1gm/L drinking water twice daily for 5 days c) Kidney Tonic @ 1ml/L drinking water Morning daily for 5 days d) Vitamin E-Selenium @ 1ml/L water evening for 5 days and Group C treated a) Neomycin sulphate (50%) @ 1gm/2L Drinking water 12hrs daily for 5 days. b) Amoxicillin (30%) @ 1gm/L drinking water 12hrs daily for 5 days c) c) Kidney Tonic @ 1ml/L drinking water Morning daily for 5 days d) Vitamin E-Selenium @ 1ml/L water evening for 5 days. Among the treatment, group A treatment group significantly reduces the disease within 3.0±0.75 days than other treatment groups.

Table-10: Effects of commercial drugs against Colibacillosis in layer

Name of the group	No. of Birds treated	Name of drugs	Dose & route of administration	Range of complete recovery (days)	Level of significance
Group A	500	a) Florfenicol b) Neomycin Sulphate (Neo vet 70) c) Kidney Tonic (Nephrocare) d) Toxin Binder (AquaTox) e) Vitamin E-Selenium (Sel E)	a) 1ml/2L Drinking water twice daily for 5 days b) 1gm/2L drinking water twice daily for 5 days c) 1ml/L drinking water Morning daily for 5 days d) 1ml/L water at noon for 5 days e) 1ml/L drinking water evening for 5 days	3±0.75 a	(0.04) *
Group B	500	a) Florfenicol (20%) b) Amoxicillin (30%) c) Kidney Tonic d) Vitamin E-Selenium	a) 1ml/2L Drinking water twice daily for 5 days b) 1gm/L drinking water twice daily for 5 days c) 1ml/L drinking water Morning daily for 5 days d) 1ml/L water evening for 5 days	5±0.25 b	
Group-C	500	a) Neomycin sulphate (50%) b) Amoxicillin (30%) c) Kidney Tonic d) Vitamin E-Selenium	a) 1gm/2L Drinking water 12hrs daily for 5 days b) 1gm/L drinking water 12hrs daily for 5 days c) 1ml/L drinking water Morning daily for 5 days d) 1ml/L water evening for 5 days.	8±0.25 c	

P<0.05 means statistically significant at 5% level of significance.

CHAPTER V

DISCUSSION

5.1 Viral disease in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

The overall prevalence of viral disease in broiler, sonali and layer chicken were 37.7%, 30.0% and 26.0% respectively which were similar with the findings of Islam *et al.*, 2023 and slightly higher than the findings of Talukder *et al.*, (2017). In broiler chicken the highest prevalence was seen in inclusion body hepatitis (18.5%) which is lower than the finding of Bertran *et al.*, (2021) who found 92% prevalence in broiler chicken. In sonali chicken the highest prevalence was seen in infectious bursal disease (15.6%) was similar with findings of Belaly and Ramman (2022) and highest prevalence in layer chicken was seen in Newcastle Disease (9.9%) which was lower than the finding of Mngumi *et al.*, (2022). These variations may due to the sample size and location and season of the year.

5.2 Bacterial diseases in commercial chicken Mithapukur upazila in Rangpur district of Bangladesh

The overall prevalence of bacterial disease in broiler, sonali and layer chicken were 20.1%, 15.6% and 42.8% respectively was similar with findings of Halder *et al.*, (2021). In broiler chicken the highest prevalence was seen in colibacillosis (10.4%) which is lower than the findings of Khatun *et al.*, (2021). In sonali chicken the highest prevalence was also seen in colibacillosis (6.3%) and lowest in salmonellosis (4.1%). Highest prevalence in layer chicken was seen in colibacillosis (13.7%) and lowest in fowl cholera (4.1%). These findings are similar with the finding of Kromann *et al.*, (2022).

5.3 Fungal, protozoan and other diseases and disease condition in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

Among fungal, protozoan and other diseases the overall prevalence of disease in broiler, sonali and layer chicken were 42.2%, 54.4% and 31.2% respectively was similar with the findings of Momin *et al.*, (2014). In broiler chicken the highest prevalence was seen in Mycoplasmosis (13.3%) and lowest in Aflatoxicosis (0.3%). Highest prevalence in layer chicken was seen in Mycoplasmosis (12.7%)

and lowest in Aspergillosis (0.7%) which were lower than the finding of Cortes *et al.*, (2021). In sonali chicken the highest prevalence was also seen in coccidiosis (32.6%) is similar with the findings of Belal (2017).

5.4 Age- wise prevalence of some predominant diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

The study reveals that the Inclusion Body Hepatitis was more predominant (63.2%) in broiler chicken in the age of 14-27 days which is similar of the earlier study of Choi *et al.*, (2012). In case of sonali chicken coccidiosis was the predominant disease where 14-40 days' age group were more susceptible (60.2%) than other age group was similar with the findings of Tipu *et al.*, (2021). Colibacillosis in layer chicken were more predominant and 101-above days age group showed highest prevalence (62.5%) rate than other age group which were higher than the findings of Matin *et al.*, (2017).

5.5 Flock size- wise prevalence of some predominant diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

The commercial chickens were divided into three different flock size. Inclusion Body Hepatitis (50.9%) in broiler chicken, coccidiosis (45.5%) in sonali chicken and colibacillosis (50.0%) in layer chicken were more affected in larger flock size of 1001-1500 is similar with the findings of Sharma *et al.*, (2015) and Shrivastava *et al.*, (2019).

5.6 Floor type-wise prevalence of some important diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

The commercial chickens were reared in two different rearing system i.e. earthen system and paved system. All the three predominant disease in earthen system were higher in Inclusion Body Hepatitis (75.4%) in broiler chicken, coccidiosis (59.1%) in sonali chicken and colibacillosis (62.5%) in layer chicken was similar with earlier study of Iqbal and Begum (2010).

4.7 Education-wise prevalence of some important diseases in commercial chicken at Mithapukur upazila in Rangpur district of Bangladesh

All the three predominant diseases at farm managed with people of primary education showed higher prevalence in Inclusion Body Hepatitis (52.6%) in broiler chicken, coccidiosis (62.5%) in sonali chicken and colibacillosis (62.5%) in layer chicken and moderate in farms managed with

people of secondary education and lower with people reared with higher education. This finding have some similarities with earlier study of Moula *et al.*, (2020).

4.8 Effects of commercial drugs against Inclusion Body Hepatitis in broiler

Farms affected with inclusion body hepatitis were commonly treated with Liver tonic (Heparen/Neomeriol) @1ml/1L Drinking morning water daily for 5 days; Kidney tonic (Nephrocare/Lumix vet) @1ml/L drinking water noon water daily for 5 days; Vitamin-C (Rena C/Vita C) (Ascorbic Acid-98%) @ 1gm/3L drinking water at noon daily for 3 days; Immunomodulator (Xillian/AIB Vet) @ 1gm/3L drinking water evening daily for 5 days with a variation in the treatment in group A with Glucose + Sodium-bicarbonate @ 7+3gm/10L drinking morning water for 5 days; in group B with Molasses 5%@ 1gm/3L drinking water noon for 3 days and in group C with antibiotic Florfenicol (20%) @ 1ml/1L drinking water 16hrs daily for 3 days. Among all treatment, group A treatment group significantly reduces the disease within 5 ± 0.75 days than other treatment groups was partially similar with the findings of Chandrakar *et al.*, (2012) and Sharma *et al.*, (2018).

4.11 Effects of commercial drugs against coccidiosis in sonali chicken

Farms affected with coccidiosis were treated with Vitamin-k (Rena K) @1gm/5L drinking water for 72 hrs; Vitamin-C (Vita C) (Ascorbic Acid-98%) @ 1gm/5L drinking water noon for 3 days; Kidney Tonic (Lumix vet) @ 1ml/L drinking water evening daily for 5 days; with a variation in the treatment in group A with Diclazuril (dmeria) (2.0%) @ 1ml/2L Drinking water 72hrs; in group B with Toltrazuril (2.5%) @ 1ml/2L Drinking water 5 days daily and in group C with Amprolium (20%) @ 2gm/L Drinking water daily for 5 days. Among all treatment, group A treatment group significantly reduces the disease within 3 ± 0.75 days than other treatment groups was similar with the findings of El-Sawah *et al.*, (2020) and Conway *et al.*, (2001).

4.12 Effects of commercial drugs against Colibacillosis in layer

Farms affected with colibacillosis were grouped into three treatment groups i. e. A, B and C and each group contain 500 chicken. Group A treated a) Colistin sulphate (Listin vet) (24lac IU) @ 1ml/2L Drinking water twice daily for 5 days b) Neomycin Sulphate (Neo vet 70) @ 1gm/2L drinking water twice daily for 5 days c) Kidney Tonic (Nephrocare) @ 1ml/L drinking water Morning daily for 5 days d) Toxin Binder (AquaTox) @ 1ml/L water noon for 5 days and e) Vitamin E-Selenium (Sel E) @ 1ml/L drinking water evening for 5 days and Group B treated with a)

Florfenicol(20%) @ 1ml/2L Drinking water twice daily for 5 days b) Amoxicillin (30%) @ 1gm/L drinking water twice daily for 5 days c) Kidney Tonic @ 1ml/L drinking water Morning daily for 5 days d) Vitamin E-Selenium @ 1ml/L water evening for 5 days and Group C treated a) Neomycin sulphate (50%) @ 1gm/2L Drinking water 12hrs daily for 5 days. b) Amoxicillin (30%) @ 1gm/L drinking water 12hrs daily for 5 days c) c) Kidney Tonic @ 1ml/L drinking water Morning daily for 5 days d) Vitamin E-Selenium @ 1ml/L water evening for 5 days. Among the treatment, group A treatment group significantly reduces the disease within 3.0 ± 0.75 days than other treatment group was similar with the findings of Mohammed Shaheen and El-Far (2013) and Rahman *et al.*, (2019)

CHAPTER VI

CONCLUSION

The study was conducted at Mithapukur Upazila of Rangpur district in Bangladesh from November 2022 to April 2023. Total 870 clinically ill and dead chickens were observed and recorded. On the basis of present findings, the following conclusions may be inferred.

- ❑ The overall prevalence of viral disease in broiler, sonali and layer chicken were 37.7%, 30.0% and 26% respectively where inclusion body hepatitis, IBD and NDV were more predominant disease.
- ❑ The prevalence of bacterial disease in broiler, sonali and layer chicken were 20.1%, 15.6% and 42.8% respectively where colibacillosis was more predominant disease.
- ❑ Coccidiosis in sonali chicken and Mycoplasmosis in broiler and layer chicken were more prevalent among other disease of commercial chicken.
- ❑ Disease prevalence were higher in middle aged broilers and sonali chicken having a flock size more than 1000 reared in floor system by the people of primary education.
- ❑ Treatment of inclusion body hepatitis without antibiotic was more effective than with antibiotic.
- ❑ A combination treatment with Diclazuril (2.0%) and Vitamin k was showed rapid recovery than other treatment group against coccidiosis of sonali chicken
- ❑ Colibacillosis in layer was best treated with the drug Florfenicol, Neomycin sulphate, kidney tonic, toxin binder and vitamin E-selenium preparation.

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