**1. Introduction**

Livestock is an integral component of the complex farming system in Bangladesh as it is not only a source of protein of animal origin but also a major source of farm power services as well as employment. Share of livestock in Agricultural Gross Domestic Product is 14.2% and livestock contributes 1.7% of GDP in the national economy of Bangladesh (BBS, 2016).

Within the livestock sector, poultry farming is playing important role in contribution to GDP and employment facility. There are 2,23,39,95 poultry farms in Bangladesh (DLS, 2015). Broiler chickens are broadly reared for meat purpose, whereas layer chickens are reared for egg purpose. The poultry meat alone contributes 37% of the total meat production in Bangladesh (Begum *et al.,* 2011). Over the last few decades poultry farming has gradually intensified and is now considered one of the intensive forms of agri-business in Bangladesh. To achieve millennium development goal Bangladesh is committed to lift up the poultry sector. Scientific breeding, feeding, management and disease control are the key points of success in poultry improvement programme. Among different poultry diseases Colibacillosis and Salmonellosis are the major problems in the commercial poultry sector.

Colibacillosis is an infectious disease caused by *Escherichia coli*. It causes high mortality rates or yolk sac infection of chicks during hatching when egg is contaminated by penetration of *E. coli* through the shell (Kabir, 2010). Avian Pathogenic *E. coli* (APEC)causessystemic infection when they gain access to the blood stream from respiratory tract or intestine. Some diseases such as infectious bursal disease, mycoplasmosis, coccidiosis, Newcastle disease or infectious bronchitis, as well as nutritional deficiencies predispose the birds to colibacillosis. Risk for colibacillosis increases if the environmental infection pressure increases. A good housing, hygiene and avoiding overcrowding are very important for reducing the risk of colibacillosis. Other factors such as duration of exposure, virulence of the strain, breed, and immune status of the bird also act as risk factor for this disease. (Rosenberger *et al*.,1985; Gross *et al*.,1992; McGruder *et al*.,1998).

Yolk sac infection, omphalitis, respiratory tract infection, swollen head syndrome, septicemia, polyserositis, coligranuloma, enteritis, cellulitis and salpingitis are common findings of colibacillosis. (Haider, 2004). In postmortem, omphalitis and fluid accumulation in the peritoneal cavity of chicks, dark-colored swollen liver and spleen, fibrinopurolent airsacculitis, pericarditis, perihepatitis, hemorrhagic enteritis, arthritis, panophthalmitis, and salpingitis are found (Nakamura *et al.,*1985).

Incidence of Colibacillosis (*Escherichia coli*) in Bangladesh is reported to be 4.4% in broiler (Giasuddin *et al.*, 2002, Matin *et al*., 2017). Higher prevalence of colibacillosis was found in broiler (87.5%) than layer (76.0%) (Srinivasan *et al*.2003). According to age, adult layer birds were commonly affected than chick and younger layer birds (36.7%) (Rahman *et al.,* 2004). While in broiler age of about one month was found to have more prevalence than more than one month age (0.5%) (Rahman *et al*., 2004).

Due to incidence of Colibacillosis heavy economic loss occurs in both broiler and layer such as increase of morbidity, mortality, reduced production and chick quality. Mortality may reach up to 94% in severe outbreak of colibacillosis (McPeake *et al.,* 2005 and Biswas *et al.,* 2006).

Salmonellosis is a bacterial disease caused by a variety of *Salmonella* species under the family Enterobacteriaceae. It may occur in poultry either acute or chronic form. Oral route of infection is the normal route of infection (Brito *et al*. 1995). In newly hatched chicken nasal and cloacal route of infection is also important. Vertical transmission in chicks may occur from an infected ovary, oviduct or from infected eggs during the passage the the cloacal faeces of infected or carrier birds. Infected young birds can survive from clinical disease but they become carriers (Berchieri *et al*., 2001). The reproductive organs are the predilection sites for *salmonella* species which causes infection of ovarian follicles that leads to transovarian transmission of the disease in adult carriers (Kabir, 2010). Some factors such as season( winter or rainy season ), hatchery of origin, feedmils, various hygienic measures(cleaning of litter material, washing of feeder and water trough, water source, feed storage etc)act as the risk factors for salmonellosis. (Angen *et al*.,1996; Rose *et al*., 1999; Skov *et al*., 1999; Cardinale *et al*., 2004b).

The pathogenicity of *Salmonella* depends on the invasive properties and its ability of to survive and multiply within the cells, particularly macrophages (Humbert *et al*.1997). These bacteria mainly multiply in digestive tract, which results into widespread contamination of the environment by bacterial excretion through feces. After invasion through the intestinal mucosa, cecal tonsils and Peyer’s patches, macrophages engulf the organisns and they spread to organs rich in reticuloendothelial tissues (RES) such as liver and spleen, which are the main sites of multiplication through the blood stream and/or lymphatic systems (Barrow *et al*.,1994).If the body defense mechanism is inadequate, second invasion and localization in other organs, particularly ovary, oviduct, myocardium, pericardium, gizzard, yolk sac and/or lungs happens.(Barrow,1993).

The gross lesions in chicks are unabsorbed yolk sac and turbid yellow color fluids in the peritoneal cavity and in adult peritonitis, discrete, small, white necrotic foci in the liver and enteritis (Hasan *et al., 2010).* It is one of the most important bacterial diseases in poultry as it cause heavy economic losses through mortality and reduced production (Haide *et al*, 2004). Incidence of Salmonellosis in Bangladesh is reported to be 5.6 % (Giasuddin *et al.*, 2002,Matin et al.,2017). The reported incidence of Salmonellosis was high in adult layers (53.3 %) followed by brooder 14.6%), grower (16.1%) and pullet (16.1%) layer chickens (Rahman *et al.*, 2004).

For the prevention and control of Colibacillosis and salminellosis, egg contamination can be prevented by fumigating them within two hours after lay. Also the cracked eggs or eggs soiled with faecal material should be removed. Introduction of the diseases must be avoided by suitable house infrastructure, using transition zone for changing clothes and shoes, and washing hands, pest control(Barnes *et al.,*1997). Bird density, humidity, ventilation, dust and ammonia, housing climate must be kept optimal (Dho-Moulin *et al*., 1999). Good hygiene and management together with routine serological tests and slaughter policy helps in achieveing successful control programs (Barrow, 1993). Chickes should be placed in a cleaned, sanitized and pathogen free environment with strict biosecurity measures (Pomery *et al*.1991).

The feed and water should be free fromcontamination and the dead birds need to be well disposed. Adequate precautions should be applied to prevent infections from mechanical carriers like footwear, human clothing, hatchery disciplines, equipments, litters, crates, trucks and processing plants (Christensen *et al*.,1994).

Antimicrobial therapy is important tool for the treatment of colibacillosis and salmonellosis. Ciprofloxacin, gentamicin, chloramphenicol were found as sensitive for both *E.coli* and *Salmonella species*. Whereas ampicillin was found resistant for this E.coli and (Miles,2006; Matin,2017). In case of salmonellosis, tetracycline, oxytetracycline, penicillin, aminoglycosides, sulfisoxazole, fluoroquinolones were found resistant (Sharma *et al*.,1996; Rahman et al.,2004).

Although studies on colibacillosis and salmonellosis in different aspects are available in scientific literature, this clinical small intern research added fresh scientific information of proportionate prevalence of these diseases and antimicrobial uses to the existing literature.

**Specific objective:**

1. To estimate the proportionate prevalence of colibacillosis and salmonellosis in commercial poultry
2. To describe the frequency of lesions and drugs prescribed against the diseases

**2. Materials and Methods**

**Internship placement and duration**: The clinical study was conducted during CVASU internal rotation in January-February2017 and then during the rotation of Upazilla Veterinary Hospital (UVH), Hathazari during March -April and July -August 2017.

**Study population**: During the rotation a total of 38 poultry in different production types (either sick or dead) were undergone post-mortem. Of the total numbers 10 birds were recruited at CVASU through the private practice of Professor Dr. Masuduzzaman (CVASU) and the rest were recruited at the UVH.

**Data collection:** Production type, age, source, ventilation and farm size were recorded using a structured record keeping sheet through farmer’s interview.

**Post-mortem procedure:**

At first the chicken was laid on its back and each leg to expose the internal organs, in turn drawn outward away from the body while the skin was incised between the leg and abdomen on each side. Then the both legs were grasped firmly in the area of the femur and bent forward, downward and outward, until the head of both femurs were broken free of the acetabular attachment so that both legs lied flat on the table. The skin was cut between the two previous incisions at a point midway between keel and vent. The cut edge was then forcible reflected forward, cutting was necessary, until the entire ventral aspect of the body including the neck, was exposed. For exposing of the viscera, knife was used to cut through the abdominal wall transversely mid-way between the keel and vent, then through the breast muscle on each side. Positioning shears were used to cut first the rib cage, the coracoids and clavicle on both side. Then the keel near the abdomen was grasped and pulled upwards to expose the internal organs. Next, we should remove the liver and spleen. A green discoloration of the liver near the gall bladder is a normal finding. The spleen is the reddish, round organ located at the junction of the proventriculus and gizzard. The air sacs were examined for increased thickness and increased cloudiness. The normal air sac surfaces look like soap bubbles or clear cellophane wrap. The outer surface of the heart should be examined for a cloudy, thickened appearance, suggesting pericarditis. Also, excessive fluid located between the heart and the pericardium (membranous covering of the heart) was noted. The gastrointestinal (GI) tract between the esophagus and proventriculus was cut. The proventriculus, gizzard, small intestines, large intestine, ceca were cut off at the level of the cloaca.

Observable post-mortem lesions were noted in a post-mortem sheet and diagnosis was made accordingly with the support of veterinary practitioners. Drugs prescribed for each case were also recorded. This study considered only two bacterial poultry diseases: colibacillosis and salmonellosis.

Colibacillosis is usually described by omphalitis and fluid accumulation in the peritonial cavity of chicks, dark-colored swollen liver and spleen, fibrinopurolent airsacculitis, pericarditis, perihepatitis, hemorrhagic enteritis, arthritis, panophthalmitis, and salpingitis in some cases (Nakamura *et al.,*1985).

Salmonellosis is usually described by unabsorbed yolk sac and turbid yellow color fluids in the peritoneal cavity in chicks and in adult peritonitis, discrete, small, white necrotic foci in the liver and enteritis (Hasan *et al., 2010)*

**Data entry and statistical evaluation:** Data obtained from the study were entered into a MS excel spread sheet and exported to Stata-13, statistical software for analysis. Descriptive statistics were performed. The results were expressed as frequency number and percentage.

**3. Results**

**3.1**. **Proportionate prevalence of colibacillosis and salmonellosis**

Colibacillosis affected the poultry at all age categories (23.5%-45.5%) in this study, whereas salmonellosis only affected adult layer poultry. By production type broiler poultry were frequently affected by Colibacillosis (76.6%) than layer poultry (11.8%). No Salmonellosis was detected in broiler poultry. Birds originated from Nahar Agro Group had comparatively more Colibacillosis and Salmonellosis than that of other sources. No clear trend of the diseases was observed in relation to the farm size categories; however poultry originated from the farm size of 500-1000 and 800-1320 were commonly affected by colibacillosis and salmonellosis, respectively. Poultry housed with moderate ventilation had less frequent of the diseases than that of poultry housed with good ventilation (Table 1).

**Table 1:** Distribution of avian colibacillosis and salmonellosis in commercial poultry according to different factors.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Colibacillosis (N=17) | | | Salmonellosis (N=21) | | |
|  | Category | Positive | % | Category | Positive | % |
| Age | 7-13 days | 6 | 35.3 | 27- 53 weeks | 12 | 57.1 |
| 14-18 days | 4 | 23.5 | 54-80 weeks | 9 | 42.9 |
| 19-57 days | 7 | 45.5 |  |  |  |
| Production type | Broiler | 13 | 76.6 | Broiler | 0 | 0 |
| Layer | 2 | 11.8 | Layer | 21 | 100 |
| Sonali ( Rhode Island Red \* Fayoumi) | 2 | 11.8 |  |  |  |
| Source (Hatchery) | Charoen Pokphand (CP) | 2 | 11.8 |  |  |  |
| Nahar Agro Group | 9 | 52.9 | Nahar Agro Group | 11 | 52.4 |
| Nourish Poultry and Hatchery Ltd | 5 | 29.4 | Nourish Poultry and Hatchery Ltd | 10 | 47.6 |
| Provita | 1 | 5.9 |  |  |  |
| Farm size | 500 | 3 | 17.7 |  |  |  |
| 500-1000 | 8 | 47.1 | 800-1320 | 11 | 52.4 |
| 1001-1500 | 2 | 11.8 | 1321-3000 | 10 | 47.6 |
| 1501-6000 | 4 | 23.5 |  |  |  |
| Ventilation | Good | 13 | 76.5 | Good | 19 | 90.5 |
| Moderate | 4 | 23.5 | Moderate | 2 | 9.5 |

**3.2 Post-mortem findings**

Commonly recorded lesions of colibacillosis were omphalitis, pericarditis, perihepatitis and air sacculitis. Poultry affected by salmonellosis produced distended ureter with the deposition of urates, necrotic liver, hemorrhagic liver and follicle, degenerated ova, white plaque in intestine and peritonitis and ascites (Table 2).

**Table 2:** Frequency distribution of different post-mortem lesions due to colibacillosis and salmonellosis in poultry.

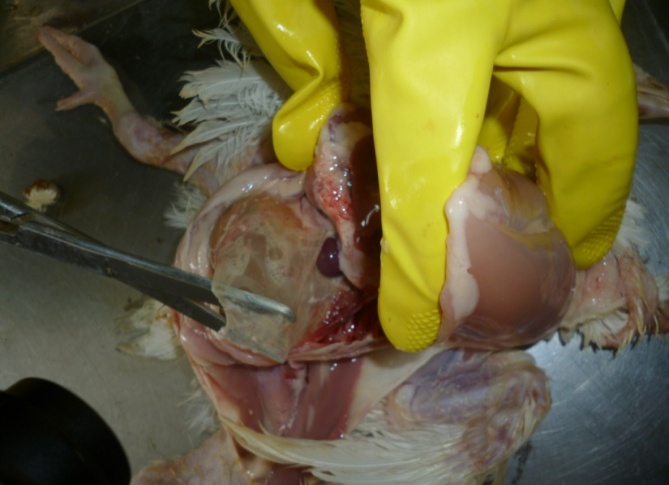
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Colibacillosis (N=17) | | | Salmonellosis (N=21) | | |
|  | Category | Positive | % | Category | Positive | % |
| Types of lesions | Omphalitis | 6 | 35.3 | Distended ureter (urates) and hemorrhagic liver | 5 | 23.8 |
| Pericarditis, perihepatitis and air sacculitis | 4 | 23.5 | Hemorrhagic follicle and necrotic liver | 5 | 23.8 |
| Pericarditis and perihepatitis | 7 | 41.2 | Peritonitis and ascites | 1 | 4.8 |
|  |  |  | White plaque in intestine, distended ureter and hemorrhagic liver | 3 | 14.3 |
|  |  |  | Degenerated ova and peritonitis | 1 | 4.8 |
|  |  |  | Degenerated ova, peritonitis and ascites | 5 | 23.8 |
|  |  |  | Degenerated ova and ascites | 1 | 4.8 |

**3.3 Drugs prescribed**

Multiple antibiotics were commonly prescribed regardless of the disease type. They were amoxicillin colistin sulphate, erythromycin, neomycin, neofloxacin for colibacillosis and amoxicillin and ciprofloxacin for salmonellosis. In addition supportive drugs were prescribed. Aminomin, CRD cure, nutrilac, superliv were given for colibacillosis affected farms and Electrolyte, glucolyte, kidney and liver tonic, liver tonic, liver tonic and gut balance were given for salmonellosis affected farms (Table 3).

**Table 3:** Different drugs prescribed for poultry affected by Colibacillosis and Salmonellosis.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Colibacillosis (N=17) | | | Salmonellosis (N=21) | | |
|  | Category | Positive | % | Category | Positive | % |
| Treatment | Amoxicillin and colistin sulphate | 5 | 29.4 | Amoxicillin | 9 | 42.9 |
|  | Erythromycin and neomycin | 4 | 23.3 | Ciprofloxacin | 12 | 57.1 |
|  | Neofloxacin | 8 | 47.1 |  |  |  |
| Supportive therapy | Aminomin | 1 | 5.9 | Electrolyte | 1 | 4.8 |
|  | CRD cure | 3 | 17.7 | Glucolyte | 7 | 33.3 |
|  | Nutrilac | 5 | 29.4 | Kidney and liver tonic | 5 | 23.8 |
|  | Superliv | 8 | 47.1 | Liver tonic | 3 | 14.3 |
|  |  |  |  | Liver tonic and gut balance | 5 | 23.8 |



Air sacculitis

Omphalitis

Fig : : Air Sacculitis found in Colibacillosis. Fig: Omphalitis found in Colibacillosis



Pericarditis

Perihepatitis

Fig: Colibacillosis in Chicken .



Degenarated ova

Fig: Degenarated ova found in Salmonellosis



Misshapen ova

Fig: Misshapen ova found in Salmonellosis.

**4. Discussion**

Development of commercial poultry sector in Bangladesh is being hampered by many factors, of which disease is one of those, causing 30% mortality of chicken per year (Das *et al.,* 2005). Avian colibacillosis and salmonellosis are important bacterial diseases in the poultry industry globally. This section discusses important findings of the current clinical study.

Very high frequency of colibacillosis was estimated in broiler poultry in the present study which is because *E. coli* usually infects chick and young birds and the current finding is also supported by number of earlier studies (Srinivasan *et a*l., 2003; Tonu et al, 2011; Rahman *et al.,* 2004). Contrarily, the quite high frequency of salmonellosis in layer adult poultry in the present study corresponds to many previous investigation (Sharma *et al*., 1996; Rahman *et al.,* 2004; Barrow, 1993)

Birds sourced from Nahar Agro Group had higher proportion of colibacillosis and salmonellosis in the present study which suggests the source might be the problem, but it is difficult to explain how the source contributed to the bird infection. This could be due to the faulty farm management practices at the destination broiler farms. There are many published studies that identified poor farm management practices (such as unfavourable housing conditions, flies and other insects, stress, feeding, density of hens on the farms, hatchery of origin, hygienic measures etc) increase the probability of risk of occurrence of colibacillosis and salmonellosis in poultry (Leitner and Heller, 1992; Renwick et al., 1992; Angen *et* *al*., 1996; Zander *et al*.,1997; Rose *et al*., 1999; Skov *et al*., 1999; and Cardinale *et al*., 2004b).

Poultry from small to medium-sized farms (500-1320) had more cases of colibacillosis and salmonellosis in this study which may be explained that small to medium-sized farms might have had poor hygienic management and thus had more cases of the diseases (Henken *et al*., 1992; Asakura *et al*., 2001)

This study demonstrates a relatively better farm ventilation facility decreased the occurrence of colibacillosis and salmonellosis which support the earlier argument of necessity of better farm management. Better ventilation always dilutes microorganism and put less stress on birds and thus less disease occurrence. This result agrees with many earlier studies (Barrow *et al*.,1993; Christensen *et al*.,1994 and Kabir *et al*.,2010).

Like many other studies Airsacculitis, omphalitis, pericarditis and perihepatitis were common lesions of colibacillosis recorded in the current study (Nakamura *et al.,*1985; Haider, 2004;). Other reported lesions of colibacillosis in poultry were congested and consolidated lung , mucus in duodenum, enteritis (Talha *et al*., 2001; Islam *et a*l., 2003; Ghosh *et al*.,2006 and Tonu *et al*,.2011).

Distended ureter with urate deposition and hemorrhagic liver and follicle and necrotic liver, peritonitis and ascites white plaque in intestine degenerated ova and peritonitis were common lesions noted in the cases of salmonellosis in the present study which are aligned with the findings of many previous studies (Barrow *et al*.,1994; Hasan *et al., 2010)*

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A range of antibiotics in different combinations was considered to include in the prescription which suggests vet practitioners did not follow any treatment protocol for specific diseases. The results also reflect indiscriminate use of antibiotics. Combined antibiotics may have been prescribed to have synergistic, potentiation and additive effects and combined drugs also reduced the MIC values, side effects etc, but indicate drugs became resistant (Shuchismita *et* *al*.,2007; Jiang *et al*.,2011; Obeng *et a*l.,2012; Ahmed *et al*.,2013; Saidi *et* *al*.,2013 and Chen *et al*.,2014)

Along with the antibiotics, Aminomin, CRD cure, Nutrilac, Superliv was prescribed as supportive therapy according to symptoms .Aminomin contains Chelated Minerals and Aminoacids which is helps in oder all returns, improve body weight and FCR in broiler.

Nutrilac is composed of formic acid, lactic acid and it acts as acidifier and helps in the action of antimicrobial for Enterobacteriaceae. Chronic Respiratoey Disease (CRD) cure is given for the protection as *E. coli* damages of the cilia of the respiratory tract and may cause chronic respiratory disease. Superliv is used for inhibition of bacteria and preventing damage to the liver (Kaur *et al*., 2005).

**5. Limitations**

This study concluded the results generated from a small sample size which could misinterpret the findings. True prevalence of the diseases has not been able to estimate as this study did not consider non-colibacillosis and non-salmonellosis cases. Information recorded was relied on farmer’s response so this could have introduced information bias. Diagnosis was based on post-mortem findings which could have introduced diagnostic error; however the diagnosis was made by experienced veterinary practitioners. It was not possible to conduct statistical significant test as there was no negative birds included in the study.

**6. Conclusion and Recommendation**

This study reflects the distribution of coli­bacillosis and salmonellosis in layer and broiler in the study areas. Broilers are found to be more susceptible to colibacillosis while only the layers are prone to salmonellosis. Better farm management can reduce the risk of these diseases. Common post-mortem lesions for colibacillosis were airsacculitis, omphalitis, pericarditis and perihepatitis and for salmonellosis, distended ureter with urate deposition and hemorrhagic liver and follicle and necrotic liver, peritonitis and ascites, white plaque in intestine degenerated ova and peritonitis. Multiple antibiotics were used for the treatments of the diseases along with some supportive treatment. For preventing these diseases better farm management and vaccination should be maintained. For the prevention of antimicrobial resistance, confirmatory diagnosis by laboratory test and using of antibiotics after performing the sensitivity test is highly recommended.

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