

ASSESSING THE POTENTIAL RISK FACTORS ASSOCIATED WITH AVIAN COLIBACILLOSIS USING A QUESTIONNAIRE SURVEY

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ABSTRACT

Avian colibacillosis is one of the most common bacterial diseases that affect poultry industry worldwide. The disease leads to economic losses in terms of carcass condemnation, reduced body weight and treatment cost etc. A questionnaire survey was conducted in two agroclimatic zones in the state of Haryana to identify the risk factors associated with occurrence of avian colibacillosis at broiler farms of Haryana along with assessment of management practices and biosecurity measures followed, knowledge of various diseases, antibiotics and disinfectants commonly used at the farm. A total of 40 broiler farms of 10 districts were surveyed. It was found that overall 29 (72.5%) farms had history of avian colibacillosis. A total of 21 (52.5%) farm owners were illiterate and 55% (n=22) had experience of 5-15 years in poultry farming. The most commonly used antibiotic was enrofloxacin (n=32 farms). On statistical analysis, the factors that were found to be significantly associated with higher avian colibacillosis were occurrence of chronic respiratory disease (CRD) at broiler poultry farms, increased use of antimicrobials in feed during summer season, litter removal only at the end of production cycle, no restriction on entry of visitors, lack of vehicle disinfection and lack of increase in supplements in feed during summer season. These factors were thus identified as potential risk factors for avian colibacillosis in the study. The odds of these factors were also significantly associated with avian colibacillosis at these farms.

Keywords: Avian colibacillosis, Chronic respiratory disease, Enrofloxacin, Poultry farms

The state of Haryana ranks 8th in broiler meat production with 0.40 MT meat per year (DAHD&F, 2017). Avian colibacillosis is one of the most common bacterial diseases that affect the poultry industry. High morbidity and mortality, poor growth rate, carcass condemnation at slaughter house and high cost incurred in treatment results in heavy economic losses due to avian colibacillosis (Nolan *et al.*, 2013). Interactions of various predisposing factors lead to occurrence of colibacillosis. These predisposing factors for colibacillosis can be categorized into three different categories: 1. bird's susceptibility, 2. environment and 3. agent. The interaction between these factors determines if disease occurs in the chicken flocks (Barnes *et al.*, 2008). Avian pathogenic *Escherichia coli* (APEC) is the causative agent of avian colibacillosis and is normally found in the intestinal tract of birds along with non-virulent strains. The APEC interacts with inadequate biosecurity and managemental practices on poultry farms to cause avian colibacillosis (Nolan *et al.*, 2013). Immunosuppression, poor chicken welfare and co-infections with other pathogens e.g. Newcastle disease virus, infectious bronchitis virus and *Mycoplasma gallisepticum*, *Pasteurella multocida* might increase the birds' susceptibility to APEC infection (Guabiraba and Schouler, 2015). Wide distribution of APEC in the bird's surroundings viz., litter, water, dust and feeders, environmental extremities and excessive ammonia levels in the shed have been found to be positively associated with increased susceptibility of birds to APEC infection among broiler chickens (Kabir, 2010). The antimicrobials

including tetracyclines, aminoglycosides, beta-lactams, quinolones, chloramphenicols and sulphonamides are mainly used for control and treatment of avian colibacillosis (Stolker and Brinkman, 2005). The rampant use of antimicrobials can also act as a risk factor for constant occurrence of colibacillosis at broiler farms.

However, little knowledge is available about the potential predisposing risk factors associated with APEC among broiler chicken in Haryana. Therefore, this present study was aimed to identify the various potential risk factors associated with avian colibacillosis.

MATERIALS AND METHODS

Questionnaire Survey of broiler farms in Haryana

state: A questionnaire was designed using EpiInfo™ software (CDC, Georgia, USA) to conduct farm-level epidemiological survey to identify predisposing risk factors associated with colibacillosis in the broiler farms. The questionnaire was also used to assess the knowledge, attitude and practices followed by farmers at these farms. The survey was conducted between July 2018 and March 2019. The sampling frame for questionnaire consisted of broiler farms of both Eastern (n=15) and western (n=25) agroclimatic zone of Haryana that were currently in production. A total of 45 questions (including nominal and open-ended questions) were included in the survey. The survey included questions on the number of birds kept on the farm, location of the farm, experience in poultry farming, management practices and general flock health. The questions covered in survey along with response of farmers have been provided (Table 1 and 2).

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Data analysis: The information collected from survey was filled in EpiInfo™ on the day of collection. All the data were then imported to SPSS statistical software for analysis. Descriptive statistics was used to measure associations between histories of avian colibacillosis at farm with all the variables collected (chi-square test). A value of $p < 0.05$ was considered significant. Strength of the associations was assessed by calculating Odds Ratios with 95% confidence interval. Those variables with value of $p < 0.05$ were considered as significant.

RESULTS AND DISCUSSION

It was observed that a total of 29 poultry farms (72.5%) had a history of avian colibacillosis outbreaks. These farmers also reported that colibacillosis occurs constantly at their farms which might be due to various predisposing risk factors which interacts together to cause the disease. This study identified six such factors (Table 1) which might be the potential predisposing factors based on their statistically significant association with avian colibacillosis history at these farms. Out of 29 farms which had history of colibacillosis, 23 farms (79%) have also reported the history of CRD at their farms. The occurrence of CRD might be providing opportunity for *E. coli* to invade as CRD infection causes respiratory lesions which is most favored route of APEC. The CRD induces stress and immunosuppression which provide another route for extra-intestinal translocation of APEC and thus colibacillosis (Guabiraba and Schouler, 2015). The odds of occurrence of CRD were 10 times greater on the farms that had occurrence of colibacillosis than on those that did not have (Table 1).

It was found that at 32 farms, litter was removed only the at the end of cycle, whereas rest of the farms removed litter or a part of litter (wet or litter under diseased birds) during the cycle. Out of these 32 farms which removed litter only at the end of cycle, 26 (81%) had avian colibacillosis history. The farms which have removed or replaced the litter during the cycle due to moisture had experienced less occurrence of disease. The reason can be less moisture in litter will prevent ammonia production in the shed, which is a stressor for birds. The frequent change in used litter might also be reducing the APEC load in the shed and thus preventing constant exposure of birds. The odds of removing litter only at the end of cycle was 7.2 times greater at the farms that had colibacillosis than of those which do not have colibacillosis (Table 1).

The unrestricted entry and movement of visitors at 25 farms was associated with higher occurrence (84%) of avian colibacillosis at these broiler farms and similarly out of 22 farms which were not following disinfection of

vehicles, 19 (86%) farms had history of colibacillosis. These findings thus suggested that lack of strict biosecurity measures provide an opportunity to bacteria to infect the birds with the help of animate (visitors) and inanimate vectors (vehicle) (Anza *et al.*, 2014). The occurrence of the disease was higher (89%) at the farms where poultry farmers themselves were involved in diagnosis and treatment of avian colibacillosis. In present study, 30 farms have used increased concentration of various antimicrobials in feeds, out of which 25 (83.3%) farms have history of reoccurrence of colibacillosis. The possible reason might be the arise of antimicrobial resistant APEC strains due to non-prudent use of antimicrobials in the feed (Langdon *et al.*, 2016). The odds of increased antimicrobials used were 7.5 times greater on the farms with history of colibacillosis than on those without disease. A total of 18 farms which have not provided supplements to birds, a higher colibacillosis occurrence (88.9%) was reported. Birds in commercial broiler production system faces various stressors which lead to decreased production and predispose immunocompromised birds to infection (CPDO, 2015). The practice of providing supplements (vitamin, minerals, liver tonics) in feed could be beneficial to bird's health and immune status and help them to overcome or neutralize stressors.

The avian colibacillosis was observed more frequently at the farms where feeders were washed at the end of cycle (90%) as compared to the farms where feeders were washed weekly (66.6%). Occurrence of colibacillosis was higher at the farms where drinkers were washed weekly (87.5%) when compared to the farms where daily cleaning of drinkers was carried out (68.8%). The disease occurrence was also found to be higher among the farms which were not disinfecting their water storage tanks. Irregular and inadequate washing and lack of disinfection of feeder, drinker and storage tank might help APEC and other organisms to build-up. Awawdeh, 2017, also reported higher APEC prevalence at broiler farms where disinfection of water and other equipments were lacking. As per guidelines of Central Poultry Development Organization (CPDO), 2015, all the poultry farms should use footbath at entry of farm. However, none of the farm in present survey was using footbath at entry of farm.

Some of the factors like litter and carcass disposal methods, educational status of owner, experience in poultry farming, source of water, use of concrete tanks over plastic tanks and insulation of roofs were found to have no significant association with occurrence of colibacillosis (Table 2). However, these can be potential risk factors due to their biosecurity significance. Omer *et al.*, 2010, observed heavy mortality due to colibacillosis at

Table 1
Risk factors significantly associated with the avian colibacillosis

Sr. No.	Group variable	Unique value	Total	Positive	Prevalence	p value (Chi-square)	Odds Ratio
	Overall		40	29	72.50		
1.	Occurrence of CRD	Yes	26	23	88.46	0.002	10.22
		No	14	6	42.86		
2.	Increased use of antimicrobials	Yes	30	25	83.33	0.008	7.5
		No	10	4	40.00		
3.	Litter removed only at end of cycle	Yes	32	26	81.25	0.013	7.22
		No	8	3	37.50		
4.	Disinfection of vehicles	Yes	18	10	55.56	0.030	0.197
		No	22	19	86.36		
5.	Restricted visitor entry	Yes	15	8	53.33	0.035	0.218
		No	25	21	84.00		
6.	Increased use of supplements	Yes	22	13	59.09	0.036	0.181
		No	18	16	88.89		

Table 2
Risk factors with non-significant association with the avian colibacillosis

Sr. No.	Group variable	Unique value	Total	Positive	Prevalence
1	Feeder cleaning frequency	Weekly	30	20	66.67
		At the end of cycle	10	9	90.00
2	Agroclimatic zones	Eastern zone	15	9	60.00
		Western zone	25	20	80.00
3	Educational status	Illiterate	21	17	80.95
		School-college	19	12	63.16
4	Health services provider	AHD/Private	31	21	67.74
		Owner himself	9	8	88.89
5	Disinfection of water system	Yes	31	21	67.74
		No	9	8	88.89
6	Water bowl cleaning frequency	Daily	32	22	68.75
		Weekly	8	7	87.50
7	Litter disposal	Sold	18	12	66.67
		Used as manure	22	17	77.27
8	Experience	1-5 years	18	14	77.78
		5-15 years	22	15	68.18
9	Insulation on roof	Yes	26	18	69.23
		No	14	11	78.57
10	Capacity of birds	5000-10000	31	23	74.19
		More than 10000	9	6	66.67
11	Water storage tank	Concrete tanks	16	11	68.75
		Plastic tanks	24	18	75.00
12	Source of water	Borewell	31	22	70.97
		Canal water	9	7	77.78
13	Gumboro outbreak history	Yes	16	12	75.00
		No	24	17	70.83
14	Transport vehicle	Rented	37	27	72.97
		Farm owned	3	2	66.67
15	Use of foggers	Yes	12	9	75.00
		No	28	20	71.43
16	Carcass disposal method	Buried	30	22	73.33
		Open dumping	10	7	70.00

the broiler farms due to absence of insulations on roofs and other cooling systems at the farms. Out of 40 farms, 22 (55%) used the litter as manure in agriculture fields, which may serve as source of infection for other animals and humans (Bhushan *et al.*, 2017). Understanding the predisposing risk factors associated with the higher prevalence of APEC can assist farm owners to implement strategies to minimize the disease. Good biosecurity and management protocols are crucial in controlling and reducing environment contamination of APEC and preventing colibacillosis (Guabiraba and Schouler, 2015).

Conclusively, this study identified the potential predisposing risk factors associated with avian colibacillosis occurrence at broiler farms in state of Haryana. Good biosecurity measures including disinfection of water and equipments, restriction on entry of visitors and vehicles can reduce the occurrence of avian colibacillosis at broiler farms. Additionally, rationale use of antimicrobials and addition of supplements in feed during summer season can be beneficial for flock health and reduction of avian colibacillosis at farms.

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