The Pharma Innovation Journal 2018; 7(4): 282-285

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(4): 282-285

www.thepharmajournal.com
Received: 12-02-2018
Accepted: 16-03-2018

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Epidemiological studies on infectious bursal disease in broiler chickens in Haryana state during 2012-2015

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Abstract
Infectious bursal disease (IBD) is an acute and highly contagious viral infection of poultry. The present study was conducted to analyse the epidemiological data of IBD in poultry from January, 2012 to December, 2015. The disease was diagnosed on the basis of clinical presentation of dullness, depression, yellowish diarrhoea, ruffled feathers and sudden increase in mortality and gross pathology. Of the 12,858 poultry flocks presented for disease investigation during the fouryears period, 585 (4.55%) flocks were affected with IBD. Overall morbidity, cumulative mortality and case fatality rate due to IBD were 4.38%, 2.62% and 59.68%, respectively. The birds of age group of 21-30 days were more affectedwith IBD as compared to other age groups. The disease was recorded throughout the year with higher incidence in autumn/spring season (n=162 flocks; 27.69%) followed by rainy season (n=151 flocks; 25.81%). Of the 585 IBD affected flocks, 400 (68%) flocks had the history of IBD vaccination while the remaining 185 (32%) flocks were unvaccinated against this disease.

Keywords: infectious bursal disease, epidemiology, poultry, Haryana state

Introduction
Infectious bursal disease (IBD) is an acute, highly contagious viral infection of poultry and it causes heavy mortality and immunosuppression in young chickens worldwide. The IBD was first discovered by Cosgrove in 1962 from an outbreak in Gumboro area of Southern Delaware. Infectious bursal disease virus (IBDV), the causative agent of IBD, belongs to the family *Birnaviridae* of the genus *Avibirnavirus*. The virus is double stranded RNA, bi-segmented (segments A and B), non-enveloped and icosahedral (Dobos *et al*, 1979; Vera *et al*, 2015) [4, 26]. Two serotypes viz.: serotype-1 and serotype-2 have been reported on the basis of virus neutralization test. Serotype-1 viruses vary in virulence and pathogenicity and can cause immunosuppression in chickens. Viruses of serotype-2 have been isolated from turkeys and are non-pathogenic to both turkeys and chickens (Mahgoub *et al*, 2012) [14].
The IBDV has a predilection for the bursa of Fabricius where the virus infects actively dividing and differentiating B-lymphocytes (Adamu *et al*, 2013; Li *et al*, 2015) [1, 12]. Due to immunosuppressive effect of the IBDV, the incidence of secondary infections may increase (Jackwood *et al*, 2012; Muller *et al*, 2012; Murmu *et al*, 2014) [5, 21, 22].
In India, the IBD for the first time was reported by Mohanty *et al*. (1971) [18] and it remained in its classical form until 1990's. The emergence of vv strains caused 10-75% mortality in layers and 10-40% in broilers in 1992-94 (Sah *et al*, 1995) [25]. After 1990 antigenic and pathotypic variant strains emerged with heavy mortality and economic losses in young chicken flocks. In a study, the epidemiological data pertaining to IBD from July 2005 to June 2008in Haryana state was analysed and the results revealed more occurrence in winter season (28.36%) (Mor *et al*, 2010) [19]. The present study was conducted to understand the epidemiology of IBD in broiler chickens in parts of Haryana by analysing the data from 2012-2015. Epidemiological studies are important as such studies indicate change in pattern of disease occurrence, which in turn may help us to formulating control strategies.

Materials and Methods
Collection of Data: The Disease Investigation (DI) Laboratory of the Department of Veterinary Public Health and Epidemiology, LUVAS, Hisar provides diagnostic services to the livestock and poultry farmers of the state. Poultry farmers visit this laboratory on regular basis for getting the diseases investigated in their flocks. The data pertaining to IBD during the period from January 2012 to December 2015 was obtainedfrom this laboratory. The disease was tentatively diagnosed as IBD based either on clinical findings or gross pathology or both.

Detailed information such as total flock size, number of birds affected, number of birds died, age of the affected birds, month of occurrence of the disease, vaccination status etc. were recorded. To study the temporal distribution of the disease, an year was divided into fourseason viz.: April to June (summer), July to September (rainy), December, January and February (winter) and October, November andMarch (autumn/spring). Data related to vaccinated and unvaccinated groups was analysed statistically using Paired Sample T-test to draw the inferences.

Results and Discussion

Occurrence of the Disease: During the period under report, disease investigation was undertaken in 12,858 flocks at Disease investigation Laboratory, Hisar. Of these,585 flocks (4.55%) were affected with IBD (Table 1). During the study period, IBD affected 1, 93, 640 birds (4.38%) with mortality of 1, 15, 564 (2.62%) birds with overall case fatality rate (CFR) of 59.68%. Percent morbidity during the four years period varied from 2.65-5.86% while percent mortality varied between 1.55-3.47%. The data revealed that the occurrence of disease was more in 2015 as compared to the years 2012 and 2013. Percent morbidity was significantly higher in 2015 as compared to other three years while percent mortality in the year 2015 was significantly higher as compared to that in years 2012 and 2014. The cumulative mortality (9.63%) reported by Rashid *et al.* (2013) [24] was higher as compared to that observed in the present study. Such a variation could be due to the reason that the data in the present study was based on one time point. No follow up was done in any of the IBD-affected flock. Based on one times values, we may hypothesize that overall percent morbidity and mortality might have been higher. Higher CFR as observed in this study may indicate acute nature of the disease. In a previous study, Mor *et al.* (2010) [19] also reported similar findings as that of the present study. It appeared that over the years (compared to the study of Jindal *et al,* 2004) [8], the incidence of the disease was decreasing. The disease is mainly controlled by sanitary measures and vaccination using either live or killed vaccines. The area of Haryana where this study was conducted is primarily a broiler chicken raising area where live vaccines are used as a measure to control the disease.

Clinical and Pathological Findings: The affected birds were dull, depressed and anorectic and had ruffled feathers. Diarrhoea, either yellowish white or greenish yellow was invariably recorded in the affected flocks. Post-mortem changes included swollen, haemorrhagic or atrophied bursa of Fabricius, haemorrhages in the musculature (particularly on thigh muscles) and proventriculus. Clinical and post-mortem findings similar to the present study had been recorded earlier (Sah *et al,* 1995; Rashid *et al,* 2013; Morla *et al,* 2016) [25, 24, 20].

Seasonal Occurrence: The disease was recorded throughout the year. The study indicated more occurrences in rainy season (Table 2). Numerically, of the total IBD affected flocks, 27.7% flocks were in autumn and spring season. Qureshi (1999) reported higher occurrence of disease in winter months (14.39%) as compared to summer months (8.89%) in Pakistan. Comparatively IBD-affected flocks were reported more in winter season than in summer and rainy seasons in Haryana state previously (Jindal *et al,* 2004; Mor *et al,* 2010) [19, 8]. The cumulative mortality in all seasons in this study varied from 2.08 to 3.28%. Though the occurrence of IBD in this study was more in autumn/spring season, comparatively percent morbidity was higher in summer (5.35%) while cumulative mortality was higher in winter (3.28%) season. High mortality in winter and summer seasons is expected due to extreme weather conditions. In summer season particularly during May and June, day temperature in this region reaches up to 46^0C to 47^0C. At such a high temperature, higher mortality may be expected due to combined effects of heat stress and IBD. Immediately after rains, there is high environmental humidity, which may also substantially increase the mortality rate. However, more comprehensivedata is required for implicating the season with disease occurrence or mortality or both. Jaishankar *et al.* (2003) reported maximum incidence of IBD in winter (43.93%) and summer (39.74%) followed by monsoon (16.74%) seasons. The CFR was the highest in winter (66.57%) and the lowest in autumn/spring season (53.72%). The CFR in other two seasons i.e, summer and rainy ranged between 59.49 to 59.50% (Table 3).

Effect of Age: The details of IBD affected flocks in different age groups of broiler chickens are presented in Table 4. Due to IBD, poultry flocks with birds of 21-30 days of age were affected the most with higher morbidity rate and CFR. In the present study, of the total flocks with birds of 21-30 days of age during four years period, 7.99% were affected with IBD. Of the total IBD affected flocks, 52.4% flocks had birds of 21-30 days of age followed by 30.4% flocks with birds of 11-20 days of age. Likewise, percent morbidity was significantly higher in birds of 21-30 days of age as compared to other age groups. Percent mortality also followed the similar pattern as that of morbidity, however, the difference between age groups 21-30 days and 31-40 days was not statistically significant. Jaishankar *et al.* (2003) reported that the birds of 0-5 weeks of age were more susceptible to the disease. Our observations are consistent with the earlier reports of Mittal (2004) [8, 16], Zeleke *et al.* (2005) [27], Mor *et al*. (2010) [19], Choudhary *et al.* (2012) [2] and Rashid *et al.* (2013) [24]. More outbreaks in older birds may be correlated well with maternal antibody titres and vaccination status of birds. Sufficient maternal antibodies may protect birds from the disease during first few weeks of life and if birds receive timely vaccination during this period, chances of IBDin birds more than 3 weeks of age would be reduced. However, improper vaccination would make birds susceptible to IBDV infection.

Vaccination Status: To study the impact of vaccination on disease occurrence, the data was analysed with regard to disease and vaccination status in flocks. Of the 585 IBD-affected flocks during the study period, 400 (68%) flocks were vaccinated and the remaining 185 (32%) were not vaccinated against IBD. Percent morbidity (4.49%) and cumulative mortality (2.64%) were higher in vaccinated flocks as compared to unvaccinated flocks (4.08% and 2.53%, respectively), though the difference was not statistically significant. However, percent CFR was comparatively higher in unvaccinated flocks (62.05%) than in the vaccinated flocks (58.9%). Mor *et al.* (2010) [19] observed that 69.15% of IBD-affected flocks were vaccinated against this disease. In contrast, Rashid *et al.* (2013) [24]found that mortality due to IBD was significantly higher in unvaccinated birds as compared to vaccinated birds.

In northern part of India where this study was conducted, intermediate or intermediate plus vaccines (both live vaccines) are generally used in commercial broiler chickens and are administered through the drinking water at 13-15 days of age. These vaccines accord protection against IBD but are

also mild immunosuppressive (Mekuriaw *et al*, 2017) [15]. A number of predisposing factors like overcrowding, poorly constructed brooder houseand poor ventilation may be responsible for IBD to occur in vaccinated flocks. Poor vaccination practices, non-maintenance of cold chains during transport and at farm, use of chlorinated water during vaccination, improper handling of vaccine, concurrent disease and low maternal antibody levels in day-old chicks may also contribute to the occurrence of IBD in vaccinated flocks. Most of the poultry farmers in this part of Haryana are not fully aware about proper handling of vaccines. If the vaccine is not properly handled and exposed to sunlight for a longer duration, it may not produce desired level of antibodies and such flocks though vaccinated but may behave as unvaccinated flocks and would be prone to the disease.

Other factor could be the use of various strains of IBD vaccines that have failed to develop the desired immune response due to antigen variations within the causative agent (Lemiere *et al*, 2013; Jakka *et al*, 2014; Mohamed *et al*, 2014) [1, 7, 17]. High mutation rate of virus may lead to the emergence of new very virulent strains (Lojkic *et al*, 2008; Kasanga *et al*, 2013; Morla *et al*, 2016) [13, 9, 20]. The very virulent strains emerged during the year 1992 in India were capable of breaking the maternal antibodies barrier. In such a situation, the disease may be observed even in a flock that has been properly vaccinated.

From the present study, it can be concluded that outbreaks of IBD occur throughout the year in broiler chicken flocks in Haryana state even after vaccination. Continuous surveillance involving different types of birds (broilers, breeders and layers) in all poultry regions of the state is essential to better understand the IBDV epidemiology. Strict biosecurity measures are required so that the impact of immunosuppression due to IBD vaccine and concurrent infection can be minimized.

Table 1: Epidemiological indices due to infectious bursal disease in broiler chicken flocks in parts of Haryana

Year	Total flocks brought to DI Lab.	No. of flocks affected with IBD (%)	Epidemiological indices of IBD affected flocks			
			Flock size	Morbidity (%)	Mortality (%)	Percent CFR
2012	4,063	128 (3.15^{c})	8,58,160	22,770 (2.65^{cd})	13,276 (1.55^{c})	58.30
2013	3,308	128 (3.87^{bc})	9,37,630	43,630 (4.65^{b})	27,121 (2.89^{ab})	62.16
2014	2,758	158 (5.73^{ab})	12,41,720	47,680 (3.84^{bc})	27,314 (2.20^{b})	57.29
2015	2,729	171 (6.27^{a})	13,80,980	79,560 (5.76^{a})	47,853 (3.47^{a})	60.15
Total	12858	585 (4.55)	4418490	1,93,640 (4.38)	1,15,564 (2.62)	59.68

*Values with superscript a, b, c within a column indicate significant difference (P<0.05)

Table 2: Seasonal occurrence of infectious bursal disease in broiler chicken flocks in parts of Haryana

Seasons	Total flocks affected	No. of IBD affected flocks (%)	Epidemiological indices of IBD affected flocks			
			Flock size	Morbidity (%)	Mortality (%)	Percent CFR
Dec.-Feb. (Winter)	3578	124 (3.46%)	964450	47540 (4.93^{ab})	31651(3.28^{a})	66.57^{a}
April-June (Summer)	3948	148 (3.74%)	1042020	55705 (5.35^{a})	33139(3.18^{a})	55.49^{b}
July-Sept. (Rainy)	2373	151 (6.36%)	1063280	38235 (3.59^{b})	22750(2.14^{b})	59.50^{ab}
Oct, Nov. and March (Autumn/spring)	2959	162 (5.47%)	1348740	52160 (3.86^{b})	28024 (2.08^{b})	53.72^{b}
Total	12858	585 (4.55)	4418490	193640 (4.38)	115564 (2.66)	59.68

*Values with superscript a, b within a column indicate significant difference (P<0.05)

Table 3: Effect of age on epidemiological indices due to infectious bursal disease in broiler chicken flocks in parts of Haryana

Age group (days)	Total flocks brought to DI Lab.	No. of flocks affected with IBD (%)	Epidemiological indices of IBD affected flocks			
			Flock size	Morbidity (%)	Mortality (%)	Percent CFR
11-20	5,983	178 (2.97^{c})	14,47,170	54,400 (3.75^{c})	29,706 (2.05^{b})	54.60^{b}
21-30	3,840	307 (7.99^{a})	23,27,280	1,14,140 (4.90^{a})	70,997 (3.05^{a})	62.20^{a}
31-40	2,879	90 (3.13^{c})	5,15,000	22,270 (4.32^{b})	13,180 (2.56^{ab})	59.18^{ab}
41-50	156	10 (6.41^{b})	1,29,040	2,830 (2.19^{d})	1,681 (1.30^{c})	59.40^{ab}
Total	12,858	585 (4.55)	44,18,490	1,93,640 (4.38)	1,15,564 (2.62)	59.68

*Values with superscript a, b, c and d within a column indicate significant difference (P<0.05)

Table 4: Effect of vaccination on epidemiological indices in infectious bursal disease-affected broiler chicken flocks in parts of Haryana

Vaccination status	No of IBD affected flocks	Flock size	Morbidity (%)	Mortality (%)	Percent CFR
Vaccinated	400	32,50,800	14,5920 (4.49^{a})	85,951(2.64^{a})	58.90
Unvaccinated	185	11,67,690	47,720 (4.08^{a})	29,613(2.53^{a})	62.05

*Values with superscript a, b within a column indicate significant difference (P<0.05)

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