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Effects of infectious bursal disease virus (IBDV) and newcastle disease virus (NDV) vaccines on performance of broiler chicks

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Abstract : The objective of this experiment was to investigate the effect of Newcastle disease virus (NDV) and infectious bursal disease virus (IBDV) vaccination on performance of broiler chicks for five weeks. Two types of poultry houses and three patterns of vaccination ($NDV^-/IBDV^-$, $NDV^+/IBDV^-$ and $NDV^+/IBDV^+$) were factorially assigned to six treatments. NDV, B1 strain and IBDV, Bursin-2 vaccine were orally administered at 5, 14 and 7, 18 days, respectively. Forty eight hundred chicks were grouped into four replications with two hundred hybro × hybro chicks per each treatment. Weight gain, feed conversion ratio (FCR), mortality and product index were surveyed at the end of experiment. Bursa index and IBDV antibody titer of chicks were weekly measured.

Weight gain of chicks vaccinated with $NDV^+/IBDV^+$ was significantly increased compared to that of other treatments at both window and windowless poultry houses ($p < 0.05$). Chicks vaccinated with $NDV^+/IBDV^+$ also showed significantly improving the FCR and mortality compared to those of other treatments at both poultry houses ($p < 0.05$). The bursa indecies of both poultry houses were high from one-day- to three-weeks-old, but were low for the rest of two weeks. IBDV antibody of all chicks was detected 100% by agar gel precipitation (AGP) test at one day old, but was not detected in $NDV^-/IBDV^-$ and $NDV^+/IBDV^-$ treatments at four weeks old. However, it showed 100% in $NDV^+/IBDV^+$ treatment. Antibody titer using ELISA showed similar trend to that of AGP test.

The results of this experiment confirmed that IBDV and NDV combined vaccine significantly improved the performance of broiler chicks.

Key words : NDV, IBDV, antibody titer, performance, broiler chicks.

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Introduction

Infectious bursal disease virus (IBDV) has been played an important role to decrease the performance of broiler chicks due to attack bursa of Fabricius[1~3]. It usually infected the lymphatic cell and macrophage and transported into bursa of Fabricius[4,5]. The virus would also increase and proliferate their progenies[6]. Those progenies destroyed and decreased the size of bursa of Fabricius cell[7]. Such lymphatic necrosis was developed in bursa of Fabricius, tonsil, spleen and Harderian gland[8~11]. As a result, immune response of chicks was significantly decreased to pathogenic microflora or other antigens.

IBDV variety was found in the aspect of disease patterns, reported in the middle of 1980's[1]. It did not increase the mortality, but exhibited immunosuppression. As a result, bursa of Fabricius became atrophied for a short time. The vaccine administration for IBDV controls only 30% of that variety. Another hypovirulent IBDV was dispersed in the area of Holland in 1987 and then continuously reported in the United Kingdom, Japan and Belgium[12].

When the chicks infected with IBDV were incised the bursa of Fabricius, transmissible virus could be observed[13]. IBDV not only increase the secondary infection but also produce proper response to other vaccines in broiler chicks. Thus, IBDV infection has induced a lot of economical loss due to two reasons in this country. First, it increased the chicks mortality for the first three weeks. Second, chicks infected with IBDV suppress immune responses and affect the secondary disease such as gangrenous dermatitis, inclusion body hepatitis, chicken infectious anemia and salmonella.

Thus, the purpose of this experiment was to investigate the effect of three pattern vaccination ($NDV^-/IBDV^-$, $NDV^+/IBDV^-$ and $NDV^+/IBDV^+$) between window and windowless of poultry housing on weight gain, feed efficiency, mortality, antibody titer for IBDV, bursa and product index of broiler chicks.

Materials and Methods

Forty eight hundred Hybro × Hybro broiler chicks were housed in floor window- and windowless-poultry houses. Artificial light was provided 24 hrs per day. Feed and water were fed *ad libitum*.

Diets contained 20.0% CP, 3,100 kcal/kg ME for the first three weeks and 18.0% CP, 3,150 kcal/kg ME for the rest of two weeks. Six treatments were allocated with four replication. Three patterns of vaccination ($NDV^-/IBDV^-$, $NDV^+/IBDV^-$ and $NDV^+/IBDV^+$) were factorially designed between window and windowless poultry house. NDV (B1 strain, Chungang Animal Transmissible Disease Research Center, Taejeon, Korea) and IBDV (Bursin-2, Solvay, USA) vaccination were orally administered at 5, 14 and 7, 18 days, respectively.

Weight gain, feed consumption and feed conversion ratio (FCR) were weekly measured. Mortalities were daily recorded. To measure the IBDV antibody titer, ten birds per treatment were weekly sacrificed by decapitation. Forty birds per treatment were killed to examine the bursa index by cervical dislocation at the end of experiment. The product index of broiler chicks was calculated as the following equation :

$$\text{Product index} = \frac{\text{Weight gain(kg)} \times (100 - \text{Mortality})}{\text{Marketing date} \times \text{FCR}} \times 100$$

Bursa index was calculated that bursa weight/body weight × 100. Blood samples were weekly taken by decapitation. The IBDV antibody titers of blood were measured using the method of agar gel immunoprecipitation (AGP) test and ELISA. All data were analyzed by the General Linear Model (GLM) procedure of SAS® (SAS Institute, 1990) and Duncan's new multiple range test[14].

Results

The results of NDV and IBDV vaccine effects on performance of broiler chicks were shown in Table 1. $NDV^+/IBDV^+$ treatments of both window and windowless poultry houses were significantly increased weight gain of all treatments ($p < 0.05$). However, weight gain of chicks vaccinated with $NDV^+/IBDV^-$ was not statistically different at both poul-

Table 1. Effects of NDV and IBDV vaccine between different poultry housing on performance of broiler chicks for 5 weeks

Treatments		Weight gain(g)	FCR	Mortaligy (%)	Marketing date	Product index[1]
Window	$NDV^-/IBDV^-$	1,397[c]	2.251[a]	14.30[a]	38	140.0[c]
	$NDV^+/IBDV^-$	1,384[c]	2.237[a]	9.60[b]	38	148.8[c]
	$NDV^+/IBDV^+$	1,615[a]	1.844[d]	1.09[d]	38	228.0[a]
Windowless	$NDV^-/IBDV^-$	1,383[c]	2.040[b]	4.41[c]	38	186.3[b]
	$NDV^+/IBDV^-$	1,378[c]	1.853[d]	2.26[d]	38	191.3[b]
	$NDV^+/IBDV^+$	1,522[b]	1.886[c]	0.95[d]	36	222.0[a]
Window	$NDV^-/IBDV^-$	1,390.2[b]	2.146[a]	9.36[a]	-	163.2[b]
	$NDV^+/IBDV^-$	1,381.4[b]	2.044[b]	5.93[b]	-	168.8[b]
	$NDV^+/IBDV^+$	1,568.8[a]	1.865[c]	1.04[c]	-	225.0[a]
Windowless		1,465.6[a]	2.110[a]	8.34[a]	-	172.0[b]
		1,427.9[b]	1.926[b]	2.54[b]	-	199.3[a]
Pooled SE		4.83	0.01	1.04	-	7.20

[a-c] Means within a row differ significantly ($p < 0.05$).

[1] Product index = $\frac{\text{Weight gain(kg)} \times (100\text{-Mortality})}{\text{Marketing date} \times \text{FCR}} \times 100$

try houses compared to that of control ($p < 0.05$). FCR of chicks vaccinated with $NDV^+/IBDV^+$ and $NDV^+/IBDV^-$ showed significant improvement compared to those of control in windowless houses, whereas only $NDV^+/IBDV^+$ vaccination exhibited significantly superior in window house to that of other treatments ($p < 0.05$). Mortality of birds vaccinated with $NDV^+/IBDV^+$ and $NDV^+/IBDV^-$ in both houses was significantly lower than that of control ($p < 0.05$). It was also significantly low in widowless house relative to that of window house ($p < 0.05$). The product index of chicks vaccinated with $NDV^+/IBDV^+$ was also significantly higher than the other groups in both poultry houses ($p < 0.05$). However, it was significantly higher in windowless than the window house ($p < 0.05$). The product index was no significance between $NDV^-/IBDV^-$ and $NDV^+/IBDV^-$, but tended to improve in $NDV^+/IBDV^-$.

Table 2. A fluctuation of IBDV antibody titers (%) of broiler chicks for 5 weeks

Treatments		IBDV antibody titers (%)					
		Day old	1	2	3	4	5 wk
Window	$NDV^-/IBDV^-$	100.0	40.0	25.0	12.5	0	0
	$NDV^+/IBDV^-$	100.0	40.0	5.0	6.3	0	0
	$NDV^+/IBDV^+$	100.0	40.0	50.0	93.3	100.0	100.0
Windowless	$NDV^-/IBDV^-$	100.0	55.0	55.0	18.8	10.0	0
	$NDV^+/IBDV^-$	100.0	38.9	10.0	5.0	0	0
	$NDV^+/IBDV^+$	100.0	40.0	60.0	80.0	100.0	100.0

Weight gain of chicks housed at windowless poultry house was differently responded to NDV and IBDV administration because the marketing date was different between window and windowless houses. In contrast, FCR and mortality of chicks housed with windowless poultry house were significantly improved compared to those of window poultry house ($p < 0.05$).

Chicks vaccinated with $NDV^+/IBDV^+$ also showed decrease the IBDV antibody at 7 days old (Table 2). After vaccinated with first IBDV, the antibody increased from two weeks of age. When the second IBDV vaccination was applied for 18 days of life, 100% IBDV antibody was observed at 4 weeks old. The IBDV antibody of broiler chicks without vaccination also decreased 7 days of age and then slowly disappeared at two weeks old (Fig 1). Geometric mean antibody titer of chicks antibody vaccinated with IBDV was less than 3,000 at four weeks old, but showed higher than 3,000 at five weeks of age. These results suggested that chicks vaccinated with IBDV could produce the minimal protective titer (3,000) to field strain at five weeks

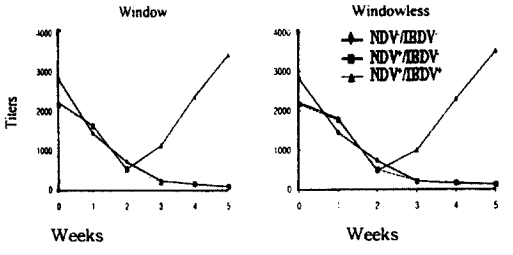

Fig 1. Effects of IBDV vaccine on antibody titer of broiler chicks for 5 weeks.

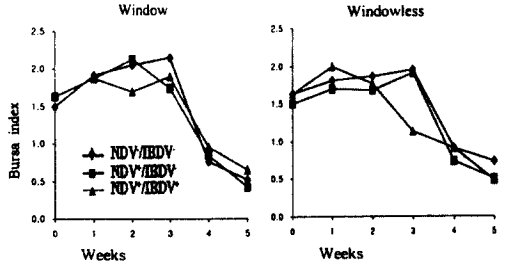

Fig 2. A comparison of bursa index in broiler chicks challenged with IBDV and NDV vaccines between window and windowless poultry housing.

of age. However, the bursa index was no significance between different houses, but decreased from 3- to 5-weeks-old (Fig 2).

Discussion

Broiler chicks with $NDV^+/IBDV^+$ combined vaccination increased weight gain and improved FCR significantly in both window and windowless poultry houses compared to that of no vaccine or only NDV vaccine treatment ($p < 0.05$). They also showed significant low mortality and higher product index compared to those of other treatments. Thus, NDV and IBDV combined vaccination would be considered to improve the performance of broiler chicks in field.

The IBDV antibody of broiler chicks without vaccination was similar to results of Koh *et al*[15] that the maternal antibody by AGP test was decreased in the time course stduy of broiler chicks. When the second IBDV was vaccined at 18 days old, 100% IBDV antibody was observed at 4 weeks old (Table 2). In this experiment, two times of IBDV vaccination recorded higher antibody titer of broiler chicks for 5 weeks than those of previous reports[15]. These results also confirmed that two times of vaccine against IBDV could induce positive immunity and was agreed with the report that IBDV challenge to broiler chicks increased its antibody titer [17]. Although the bursa index decreased from 3- to 5-weeks-old (Fig 2), there was no significance of all treatments between different poultry houses. Thus, IBDV vaccination may not related with the bursa index.

In conclusion, NDV and IBDV combined vaccination at both window and windowless poultry houses significantly improved the weight gain, FCR, product index of broiler chicks for 5 weeks and decreased their mortality compared to those of other treatments ($p < 0.05$). Antibody of broiler chicks vaccinated with IBDV was greatly increased from 3-weeks of age and exhibited 100% IBDV antibody at 4-weeks-old. Therefore, two times of IBDV challenge vaccine to broiler chicks would be needed to improve the performance of broiler chicks for 5 weeks.

Thus, to improve the performance of broiler chicks vaccinated with IBDV, further studies need to be related with

virus transmission, dietary antibiotics, safety and protective effect of vaccine virus strain, and interference with other viral and bacterial pathogens.

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