ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

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International Journal of Poultry Science 3 (6): 415-418, 2004

Residual Pathogenic Effects of Infectious Bursal Disease Vaccines Containing Intermediate and Hot Strains of the Virus in Broiler Chickens

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Abstract: The detrimental outcomes of intermediate and hot infectious bursal disease virus (IBDV) vaccine strains in broiler chickens were the objective of this study. Carcass weight gain, bursal enlargement and hemorrhage in the muscles were the parameters considered to monitor these effects. Two hundred, day-old broiler chicks were divided into eight groups namely A, B, C, D, E, F, G and H. Chicks in groups A, B and C were vaccinated with intermediate, hot and both vaccine strains of the virus respectively whereas group D left without vaccination as control in closed pens. Chicks in groups E, F, G and H were treated similarly but in open pens. In both systems of rearing, the highest effects of the vaccines on chicks performance was observed for those vaccinated with the hot strain of IBDV, followed by intermediate strain vaccinated chickens and least effect on those vaccinated with the intermediate and boostered with the hot one. The results obtained also showed that chickens reared in closed pens put slightly higher ($p<0.05$) body weight, low levels of bursal enlargement and relatively low hemorrhage in the muscles as compared to those reared in open pens. As a conclusion and recommendation, it was advised to vaccinate chickens with intermediate strains of IBD at 2 weeks old and booster them with the hot one at 3 weeks in closed systems.

Key words: IBDV, hot and intermediate strains, body weight, bursa, hemorrhage

Introduction

Infectious bursal disease virus (IBDV), member of the *Birnaviridae* family and genus *avibirnavirus* (Murphy *et al.*, 1999), is responsible for an acute highly contagious viral infection for young chicks (Parkhurst, 1964; Lukert and Saif, 1991). Devastating outbreaks of the disease were reported in many parts of the world (Chettle *et al.*, 1989; Hair-Bejo, 1992; Nakamura *et al.*, 1994; Farooq *et al.*, 2003). The disease was particularly important due to high mortalities, lowered productivity among infected chicks (Shane *et al.*, 1994) and immunodepression to other infections and vaccines (Giambrone *et al.*, 1976; Li-Wei and Cho, 1980; Yuasa *et al.*, 1980; Sharma *et al.*, 2000; Ali *et al.*, 2004). The control of the disease was confirmed to depend on the proper immunization schedules coupled with the maintenance of good hygienic conditions at the farm (Wyeth and Chettle, 1990; Whitfill *et al.*, 1995; Haddad *et al.*, 1997; Farooq *et al.*, 2003).

The IBD vaccines had been categorized into mild, intermediate and hot vaccine strains according to the bursa/body weight ratios detected following vaccine administration (Michele Guittet *et al.*, 1994). Mild vaccines did not induce bursal lesions and used in parent chickens to produce primary response prior to vaccination with inactivated vaccine (Skeeles *et al.*, 1979). Intermediate strains enlarge the bursa up to twice the normal size and used to protect broiler chicken, commercial layer replacements and young parent chicken if there is a high risk of infection with virulent IBDV (Rosales *et al.*, 1989). Hot strains cause enlargement in the bursal size three times the normal and subclinical IBD, used in young chicks in very severely affected areas (Lohren, 1994). The present investigation is targeting the residual pathogenic effects of some intermediate and hot vaccine strains of IBDV on the performance of broiler chicks.

Materials and Methods

Experimental chicks: Two hundred, one-day old, broiler chicks were obtained from Koral Commercial Poultry Farm (Khartoum, Sudan). They were divided into eight groups namely A, B, C, D, E F, G and H (25 chick per group). Chicks in groups A, B C and D were raised in slatted cage in experimental house and vaccinated with intermediate, hot, both vaccine strains of the virus and control respectively. Groups E, F, G and H chicks were left in open pens and vaccinated with intermediate, hot, both vaccine strains of the virus and control respectively. The body weight was measured and the mean calculated for each group of chickens before vaccination. Feed and water were given to them ad libitum.

Vaccines: The IBD vaccines containing the intermediate strain (D78) and hot strain (Lz228E) of the virus were used in this study. Both vaccines are live freeze-dried, grown on embryonated eggs.

Table 1: The pathogenic effects of intermediate and hot IBDV vaccine strains in broiler chickens

Vaccination Schedule	Parameter		
	Carcass wt gain (gm)	Bursal size enlargement	Hemorrhage
Closed pens			
A	819.23*±2.45	-	NH
B	734.82±2.78	++	HH
C	876.67±1.47	-	NH
D	852.21± 2.36	-	NH
Open pens			
E	790.08±2.52	+	H
F	727.91±1.89	+++	HHH
G	844.35±1.88	-	NH
H	800.51±2.49	-	NH

* The difference in carcass weight before and after vaccination (geometric mean± s.d.) n= 12.
+ slight, ++ moderate, +++ severe, - no enlargement in the bursal size was observed.
H light, HH moderate, HHH severe, NH no hemorrhage in the chickens muscles was observed (The severity was determined according to the number of muscles affected).

Vaccination procedure: The intermediate strain vaccine (D78) was given to birds at two weeks of age while the hot vaccine (Lz228E) was given at three weeks of age. Both vaccines were applied orally in the drinking water. Chicks were fasted three hours before vaccination. 0.1 ml of reconstituted vaccine diluted in 800 ml of tap water and skimmed milk (1: 400) was added to minimize the effect of chemicals used to purify drinking water as recommended by the manufacturer. Following vaccination of birds, ten chicks were sacrificed from each group for detection of bursal enlargement and hemorrhage on the muscles after one week of each vaccine given. At 42 days of chicken age, the remaining in each group was sacrificed for carcass weight measurement. The carcass weight gain was calculated as the difference between the weight at 42 days and weight before the vaccination.

Statistical analysis: The significance of differences of carcass weight gain between any two groups of chickens was determined using the Student's independent t-test.

Results

The pathogenic effects of both the intermediate (D78) and hot (Lz228E) vaccine strains of IBDV in broiler chicks as for carcass weight gain, bursal size enlargement and hemorrhage in the muscles are summarized in Table 1. The carcass weight gain for any group of chickens reared in closed pens is slightly higher than those in the corresponding group reared in open pens with non-significant levels ($p<0.05$). The bursal size enlargement and hemorrhage in the muscles are also lower in closed pens chickens than open pens ones. The broiler chicks performance (carcass weight gain) is usually better for groups vaccinated with the intermediate strain firstly and boostered with the hot vaccine, followed by those vaccinated with intermediate alone and least performance showed by those vaccinated with the hot vaccine alone. The adverse trend was observed for the bursal size enlargement and hemorrhage parameters used.

Discussion

The infectious bursal disease (IBDV) vaccine strains used to control the disease worldwide are subjectively classified as mild, intermediate and hot strains based on their capability to neutralize the MDA and cause bursal tissue damage and enlargement (Michele Guittet *et al.*, 1994). In this scientific communication, the pathogenic effects of the intermediate (D78) and hot (Lz228E) strain of IBDV vaccine in the broiler chicks as for carcass weight, bursal enlargement and the hemorrhage on the muscles were determined. The results obtained revealed that the hot vaccine is usually harmful on the broiler chick performance than the intermediate one. This suggests that the hot vaccine can neutralize high levels of MDA in the chick serum and consequently cause bursal and other tissue damage compared to the intermediate strain. This is in agreement with Rosales *et al.* (1989) and Lohren (1994). It was previously established that the IBDV vaccine is more harmful to the bursal tissues resulting into immunosuppression when given at three weeks of chicken age (Lukert and Mazariegos, 1985; Ali *et al.*, 2004). This is supported by the findings of this study as the hot vaccine was administered at three weeks of chicken age. It was also noted that the effect of the hot vaccine strain is less profound when used as a booster vaccine, and this could be attributed to the *in vivo* neutralization of the vaccine virus by the antibody produced against the intermediate strain as both of them of the same serotype.

The correlation between the vaccine strain and body weight gain was also observed in this study. Similar observation was published by Hair- Bejo *et al*. (2004). The bursal enlargement is more obvious in chicks vaccinated with the hot strain followed by vaccination with the intermediate strain and least in those vaccinated with the intermediate and boostered with the hot one. This may be associated with the proliferation of the vaccine virus in the bursal tissues resulted in apoptosis of the cells with increased cellularity and proliferation which was reported earlier by Ojeda *et al*. (1997). The same trend was observed for the hemorrhage in the muscles, which was previously explained by Skeeles *et al*. (1979) who found an increase in the clotting time in the IBDV infected chickens contributing to the hemorrhagic lesions associated with the disease

Slightly better performance of the broiler chickens was observed in those reared in closed pens. This can only be justified by the fact that chicks in the closed system can better take the vaccine as compared to those in the open pens and thus elicit better antibody responses and hence show lower pathogenic effect of the vaccines used.

In conclusion, broiler chickens vaccinated against IBD with the intermediate strains of the virus at 2 weeks old and boostered with the hot one at 3 weeks showed better performance especially if reared in closed system.

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