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Evaluation of two different Newcastle disease vaccination programs in broiler breeder chickens by HI tests

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ABSTRACT

The objective of this study was to investigate the serological differences of two different Newcastle Disease (ND) vaccination program in broiler breeder farms. Ninety broiler breeder chickens was selected and randomly distributed in three groups (each group with three repetitions). In two experimental group two different vaccination programs was used and group three was as a control group and the ND vaccine was not used. On days 1, 30, 110, and 145 blood samples were collected and examined with HI test. For Data analyzing One-way ANOVA statistical method was used for compare antibody titers against Newcastle disease and statistical software was PASW SPSS 18th edition. Results of HI test showed that mean of antibody titers was higher in the groups that ND vaccines was used, and also HI antibody titer in group that inactivated vaccines was used statistically different from the group that was not used ($p<0.05$). Because of economical losses causes by ND disease, it is necessary to applying exact vaccination programs in broiler breeder flocks and observes of biosecurity to decrease economical losses.

Key words: Newcastle disease, broiler breeder, Vaccination Program, Hemagglutination Inhibition

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INTRODUCTION

Newcastle disease (ND) is a highly contagious viral disease affecting various wild and domestic avian species [15] The impact of ND is most notable in domestic poultry due to the high susceptibility of poultry and the severe consequences of outbreaks of virulent strains on the poultry industries. In fact, it has been argued that ND may represent a bigger drain on the world economy than any other animal viral disease [1]. In response to the threat presented by ND, several countries have put in place vaccination campaigns to prevent epizootics. However, outbreaks have been reported in vaccinated populations despite the fact that vaccination is widely applied [4], as for example in The Netherlands in 1992 to 1993, the UK in 1997, and the USA in 2002 [1].

It is known that vaccination of poultry provides an excellent means to lessen clinical signs of infection caused by virulent Newcastle disease virus (NDV) [1, 9, 16]. It has also been known for a long time that vaccination itself (with live vaccines based on non-virulent virus strains) may cause disease and reduced growth in vaccinated birds. As a consequence, there has been a trend to use ever less virulent strains as the seed viruses for vaccine production. Although this strategy has reduced the disease rates after vaccination, it also may have contributed to the act that current vaccines and vaccination campaigns are not maximally effective in preventing infection and transmission [4, 9, 16, 19].

Hence, it is not clear whether the ultimate goal of prevention of major outbreaks after primary virus introductions can be achieved with current vaccines and vaccination programs. Vaccination of large numbers of broiler chickens

against ND is usually carried out using non-virulent live virus that is administered by spray or atomist, or via drinking water. These administration techniques usually produce considerable variation in the individual antibody immune responses of vaccinated birds, indicating potential variation in the levels of protection after vaccination [16]. Therefore, a main question in the control of ND is whether virulent viruses are able to spread in heterogeneously vaccinated populations, and, more specifically, under which conditions (vaccination coverage level, distribution of antibody titers) epidemic spread can be prevented.

Different strategies can be implemented to effectively prevent and control the spread of animal diseases at international, national and farm levels and poultry disease control plans often include the use of vaccination. Vaccines are, in fact, an important component of poultry disease prevention and control worldwide. Their use in poultry production is traditionally aimed at avoiding or minimizing the emergence of clinical disease at farm level and thus increasing production. Vaccines and vaccination programs vary widely, depending on several local factors (e.g. type of production, level of biosecurity, local pattern of disease, status of maternal immunity, vaccines available, costs and potential losses). Although poultry vaccination is generally managed by the poultry industry, it has only rarely been applied in the framework of a disease eradication program at national or regional level to control a few major poultry diseases (e.g. Influenza and Newcastle) [1].

The aim of present study was to compare two different vaccination programs against Newcastle disease's in broiler breeders by HI method.

MATERIALS AND METHODS

Ninety broiler breeder chickens was selected and randomly distributed in three groups (each group with three repetitions). In two experimental group two different vaccination programs was used and group three was as a control group and the ND vaccine was not used. On days 1, 30, 110, and 145 blood samples were collected and following serum isolation, the samples undergoes HI test and antibody titers obtained from each of vaccines were evaluated.

A vaccination program in two experimental groups was indicated in table 1, and in control group vaccine was not used.

Table1: vaccination programs in experimental groups

Day of vaccine administration	Group 1	Group 2
10	B1	B1+ND killed (inj)
25	Clon30	Clon30
38	Clon30	Clon30
60	Clon30	Clon30
100	Clon30	Clon30
126	--	ND inactivated vaccine

Statistical Analyzing

For Data analyzing One-way ANOVA statistical method was used for compare antibody titers against Newcastle disease and statistical software was PASW SPSS 18th edition.

RESULTS AND DISCUSSION

The results of study showed that the antibody titer was different significantly between studied groups and inactivated vaccine that was used in group 2 was increase antibodies levels, Also on day 110 and 145 there was significant differences between two vaccinated groups ($p<0.05$). The Results of flocks antibody monitoring was demonstrated in table 2:

Table 2: The results of antibody titers evaluation on days 1, 30, 110, and 145

Group	Day			
	1	30	110	145
1	6.24±0.91	3.9±0.788^{b*}	6.25±0.910^{b}	5.85±0.988^{b}
2	6.29±1.01	4.35±0.875^{b}	6.85±0.896^{c}	7.65±1.182^{c}
Control	6.26±1.14	1.50±0.688^{a}	0.50±0.514^{a}	0.15±0.366^{a}
Sig.	0.975	0.001	0.001	0.001

** Different letter in each column, indicated statistical difference between groups.*

Our results indicated in the control group, which any Newcastle disease vaccine was not used, antibody titers was decreased and the unvaccinated chickens susceptible to disease. In group 1only live vaccines was administered and the antibody titers was reach to 6.25±0.910 on 110-day old and then decreased to 5.85±0.988 on day 145. Any of the above HI titers was not protect chickens against Newcastle disease. In group 2 because of inactivated vaccine use antibody titers was reach to 7.65±1.182 on 145-day old and that titer could protect chickens against infection in farm condition.

The virus of Newcastle disease is very important from financial aspect. Disease losses in most countries, beside of its prevalence is exerting the accurate and principled controlling program that is one of the most costly disease. In some countries the Newcastle disease is endemic thus considered as one of the limiting factors in poultry industry [10]. Epidemiologically, the viruses of Newcastle disease are allocated into five pathotype that causes most important economical disease of poultry, specially its velogenic pathotypes [1].

Vaccination as a mean of protecting birds against ND is routinely practiced in world. Despite extensive use of vaccines, outbreaks of ND are still recorded due to failure of effective cold chain system, which is required for the maintenance of efficacy of vaccines.

Researchers indicated that although vaccination generally provides good protection against disease and mortality, but it may not provide sufficient protection against virus transmission so as to be able to prevent or halt epidemics of Newcastle Disease. Their finding was of considerable interest as it brings into question the epidemiological effectiveness of current vaccination campaigns against ND. Overall, analyses indicate that a high fraction of birds (>85%) needs to have a high antibody titer (log2 titer ≥3) after vaccination to ensure that no epidemic spread is possible in vaccinated populations [18].

The general question is whether it is possible to obtain consistently high antibody titers using the current vaccines of ND vaccines that are based on viruses of low virulence. Unfortunately, there are no systematic studies that have investigated the distribution of antibody titers after vaccination of large populations of poultry. A pilot experiment in The Netherlands suggests that it may be possible to obtain high antibody titers in the majority of birds, but only if strict preconditions on the vaccine content and administration techniques are met. It should also be noted that in the absence of circulation of virulent virus in a region there may be an incentive for farmers to use vaccination schemes and procedures that are not epidemiologically optimal because of the negative side-effects of vaccination [18].

Bwala *et al*., indicated that no statistically significant difference could be found in the protection offered by Avinew® vaccine against GPMV as compared to RCV challenge. The protection offered against the ND challenge was found to be dose dependent. At the recommended field dose of $10^{6.0}$ EID_{50} the vaccine gave 100% protection from mortality against both the challenge viruses, but not against infection and replication of the viruses, as gross lesions were evident even in apparently healthy birds that survived the challenge. The protective dose of the Avinew® vaccine against GPMV challenge was calculated at $10^{4.38}$ and against that of RCV at $10^{4.43}$ [5].

Also other researchers demonstrated that the protection achieved from vaccination, however, inhibit the challenge viruses from infecting and replicating in the host tissues and organs, as varying degrees of gross pathology were encountered even in the apparently healthy challenged birds that were euthanized, and it was reported that vaccination of poultry against ND can only protect birds from the more serious consequence of virulent NDV infection (clinical signs and mortality) but not infection and replication of the virulent strains of the virus [2, 9, 11].

In a research that was compare La Sota vaccine intraocularly and Mukteswar vaccine by the drinking water route, the results demonstrated that the La Sota vaccine has highest titer of HI antibodies and Mukteswar has lowest titers of HI antibody against ND prior to challenge. Also it was reported that for all vaccines intraocular administration produces higher protection than drinking water vaccine [12].

There was different vaccines available for controlling of Newcastle disease, and it is declared that live vaccines are easy to apply and relatively inexpensive and give moderately good immunity. Vaccination reactions to live vaccines vary according to the vaccine strain. Among the live vaccines, the heat resistant vaccines have the significant advantage for village use of easy transportation and they have also been widely used in villages. Recombinant vaccines have the advantage that they can be serologically detected independently of the wild virus [3]. The choice of which vaccine to use is going to depend not only on the preceding factors, but also on the conditions pertaining to a particular region, such as the structure of veterinary services, previous experience, the population distribution, the communication infrastructure and the climate.

Comparison of three commercial ND lentogenic vaccines and a V-4 vaccine, showed that all vaccines primary responses were similar, but in the second vaccination, La Sota and V4 vaccines were better than RDFV vaccine [13]. Also researchers indicated that chickens vaccinated with live Newcastle disease vaccine and subsequently revaccinated with an inactivated oil emulsion vaccine had high and persistent HI antibody titers for at least 40 weeks. The geometric mean HI antibody titers of flocks vaccinated with the inactivated ND vaccine ranged from 48.8 to 91.9, whereas the titers of flocks vaccinated every 90 days with a live ND vaccine ranged from 8.6 to 43.5. Breeder flocks revaccinated with a live LaSota ND vaccine had lower egg production than the flocks vaccinated with the inactivated vaccine. The average egg production per hen for the 40 week laying cycle was 177.8 and 174.8 eggs per hen for hens vaccinated with the inactivated vaccine, whereas those hens vaccinated with the live virus vaccine averaged 163.0 and 155.6 eggs per hen. The increase in egg production would more than offset the additional cost of the oil emulsion NDV vaccine as well as the cost of injecting each individual bird at point of lay [8].

Researchers demonstrated in twenty-week old broiler breeder chickens that had received previous live virus vaccination with NDV and IBDV were injected intramuscularly with the monovalent or bivalent vaccine. The antibody titers to either the monovalent vaccine or bivalent vaccine increased rapidly and then remained at high levels for the duration of the 40-week trial. There were no practical differences in amplitude or duration of the antibody response to either antigen used alone compared to that of the bivalent combination [17].

Certainly, researchers have shown that infection, shedding, and transmission of virulent NDV in vaccinated birds may occur without overt disease signs [9, 18]. Given this possibility we believe that, if preventive vaccination programs are to be implemented, they should go together with a monitoring program ensuring that sufficient flock immunity levels are achieved. Similar views have recently been expressed for highly pathogenic avian influenza viruses in poultry [6, 7, 14].

CONCLUSION

The results of current study showed that the use of inactivated ND vaccine in broiler breeder is necessary and it should be used before laying period. Also for prevention from loss of egg quality and egg production and hatching decrease we should obtain high level of antibody titers in broiler breeder farms.

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