Laboratory evaluation of live and inactivated Newcastle disease vaccines: 
Their application in the Newcastle disease enzootic region

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=ABSTRACT=

Laboratory trial was conducted to evaluate the efficacy of live and inactivated Newcastle disease (ND) virus vaccines using SPF birds and broilers. The speed of protection administrated by each spray and eye drop vaccination was evaluated. The serological and post-challenge data indicated that most respiratory and enteric strains of ND live vaccines used in this study induced solid antibody responses as well as early protection against challenge by either fine spray or eye drop vaccination. Furthermore, we did not found significant post vaccination reactions caused by fine spray vaccination if properly administered. However, most enteric strains of ND live vaccine, except the VG/GA strain, did not induce both solid serological reactions and not provide early protection against challenge by coarse spray vaccination, and needed about 10 times higher virus titers compared to the respiratory strains of ND live vaccine for early protection.

Present studies also elucidated that simultaneous vaccinations with live vaccine by fine spray and inactivated oil vaccine, were useful methods for broilers in ND enzootic season. These data indicated that the type of vaccine strain, vaccination method, vaccine dose, and the particle size of sprayer influenced the efficacy of ND vaccine.

Key words : newcastle disease, vaccination, evaluation, enzootic region.

Introduction

Newcastle disease (ND) was first reported in Java, Indonesia and Newcastle-upon-Tyne, England in 1926. However, it is suspected that there were already previous ND outbreaks in Korea during 1924 and in central Europe prior to 1926[1, 2]. ND is a worldwide disease that causes substantial economic impact to the poultry industry. Clinical signs of ND vary from extremely mild respiratory or enteric disease (avirulent viruses) to severe systemic infection, resulting in high mortality (virulent viruses) which is characterized as highly contagious disease[2].

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The epidemiological situation of ND in South Korea was characterized as periodic epizootics which resulted from the decreased use of vaccine, where enzootic infections usually occurred, especially in winter season[9]. Many chicken flocks, mostly broilers, in South Korea were infected with ND at the early stage of growing period, which often induced high mortality up to 50~100%[14, 15]. In that study, it was pointed out that the major factor of this ND outbreak was due to vaccine failure caused by drinking water vaccination using nipple water supply system. As described in previous studies, the major factors of ND outbreaks in South Korea are the following. First, most farmers were unwilling to vaccinate because of clinically produced vaccine reaction. Second, farmers used the nipple water drinking system which has been recognized as low effective method in order to achieve good immunity by vaccination. To achieve satisfactory immunity with minimal unwanted vaccine reaction, especially in early stage of broilers, evaluation is needed for the live vaccine strains that are currently used along with vaccine administration methods in order to select the most effective system[1, 6].

Various kinds of live ND vaccines with different pathogenicity have been used in South Korea. Besides lentogenic respiratory strains such as B1 and La Sota strain, asymptomatic enteric type of vaccines are commonly used at hatchery for early protection against ND infection. In the present study, the asymptomatic enteric type of vaccine was provisionally divided into two groups based on their pathogenicity index, group 1 with ICPI values 0.0 and group 2 with ICPI values that ranged from 0.11 to 0.39, for evaluation of their efficacy. Generally the ND immune response is positively correlated with the pathogenicity index of the live vaccine. Therefore, to obtain the solid level of protection without serious vaccine reaction, vaccination programs need to consist sequential use of progressively more virulent viruses or live virus followed by inactivated vaccine[2].

In this study, we evaluated the commercial ND live vaccines currently used in South Korea, specially focused on the onset of immunity depending on the vaccine strain and administration method for early protection. In addition, this study was conducted to figure out the effect and adverse side effects of spray vaccination which depends on the vaccine virus strain, virus titer and droplet size of sprayer. This results can contribute to establish the useful vaccination programs for broilers under high risk conditions.

Materials and Methods

1. Vaccines

Eight commercial vaccines were obtained and used at the recommended dosage. At the end of each trial, eight commercial ND vaccines were titrated using 10-day-old specific pathogen free chicken (SPF) embryos. The titers of the commercial ND vaccines used in this study are shown in Table 1.

2. Chickens and challenge

One-day-old SPF chicks were used after hatching in our laboratory originated from SPF eggs (Sunrise farms, Inc., Catskill, NY). Maternally immunized broiler chickens, which were originated from commercial flocks that had been vaccinated against ND, were used in each experimental age group. All experimental chickens were kept in separate positive pressured isolator except for field trial chickens. Each group of vaccinated and unvaccinated chickens was challenged with the viscerotropic velogenic “Kr-KJW/49” strains of NDV with \(10^{5.5}\) EID\(_{50}\) per bird by intraocular inoculation. NDV strain Kr-KJW/49 is the standard official challenge strain used in South Korea for vaccine evaluation. Chickens were kept under observation for 14 days after challenge.

3. Hemagglutination inhibition (HI) test

The HI test was performed as described in the OIE manual of standards diagnostic tests (http://