Efficacy of Live Vaccines and Specific Prevention in Chicken Infectious Bronchitis

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ABSTRACT

Infectious bronchitis of chickens (IBC) is a highly contagious disease characterized by damage to the respiratory tract. Adult chickens exhibit respiratory symptoms, a 10-50% decrease in egg production, discoloration of the eggshell, deformation of the shell, and a deterioration in the marketability and breeding quality of eggs. The circulation of variant strains in poultry farms of the Russian Federation causes a significant decrease in egg production and the quality of the eggs obtained, causing significant economic damage to industrial poultry farming. The study aimed to presents materials and methods for the industrial and efficient use of live-vaccines against infectious bronchitis of hens from a variant strain. After the use of a live vaccine against infectious bronchitis of chickens from a variant strain, the development, live weight of chickens, and feed conversion during the rearing period were within the standard parameters. In present study, the safety for the growing period with a planned 97.6% was 98.8-98.9%. The uniformity of the herds when transferred to hen - hen was 94-95%. When carrying out immunoprophylaxis of IBS, local immunity is important, which can be ensured using a live spray vaccine - a method starting from the day old. When establishing circulation in the economy of variant strains of IBC virus, it is necessary to introduce vaccination against the variant strain into the scheme of treatment and preventive measures. The research results allow us to conclude that, for the effective prevention of chicken infectious bronchitis, immunization against IBS from variant strains should be introduced into the vaccine prevention scheme.

INTRODUCTION

Infectious bronchitis of chickens is a highly contagious disease characterized by damage to the respiratory tract, as well as the urogenital system of birds. The causative agent of IBC is an RNA-containing virus belonging to the Coronaviridae family. Currently, more than 100 field variants of the virus have been isolated and serotyped (Momayeze et al., 2001; Setta et al., 2018). Chickens of all ages are affected and chickens up to 30 days old are most susceptible to infection. Ways of infection – aerogenic, contact, transovarial. Clinical signs in chickens 1-30 days of age are manifested by lethargy, drowsiness, loss of appetite, rhinitis, sinusitis, conjunctivitis, outflows from the nose and eyes, wheezing. Mortality can be up to 10-35%. Adult chickens show slight respiratory symptoms, a 10-50% decrease in egg production, while egg production does not recover even after recovery, discoloration of the eggshell, shell deformation, deterioration in the commodity and breeding qualities of eggs (Calnek et al., 1997; Cavanagh and Naqi, 2003; Birhan Mas et al., 2019). The causative agent of chicken infectious bronchitis is characterized by high mutagenesis abilities (Javadov et al., 2020). Changes in the genome of the causative agent of IBS occur as a result of point mutations, deletions, insertions, and recombination. Variants of the IBC virus by the recombination mechanism arise when different strains of the pathogen infect the same cell. The first outbreaks of chicken infectious bronchitis caused by variant strains date back to the 80s of the last century, while vaccine manufacturers for industrial poultry farming faced the question of developing and introducing new vaccines against IBC that could protect the bird from variant IBC strains. In this regard, studies were carried out to determine the strains that would have the greatest cross-protection against various field strains and the least reactogenicity (Calnek et al., 1997; Cavanagh and Naqi, 2003).

The problem of chicken infectious bronchitis in industrial poultry farming as one of the pathological factors has now received a new development. This is due to the identification in different regions of the world, including in the Russian Federation, new field strains of the IBC virus,


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which differ in antigenic activity and have different virulence for birds. Circulation in poultry farms of virulent field, incl. variant strains of the IBC virus significantly complicate the diagnosis and specific prevention of the disease. The circulation of variant strains in poultry farms of the Russian Federation, in addition to the case of poultry, leads to a significant decrease in egg production and the quality of the resulting egg, causing significant economic damage to industrial poultry (Calnek et al., 1997; Bourouga et al., 2009; Balikina et al., 2018, 2018b). A variety of live and inactivated vaccines are widely used to prevent infectious bronchitis in chickens (Salman et al., 2019; Abd El-Fatah et al., 2020). It has been established that vaccination with a strain homologous to the one circulating in the region gives far better protection than vaccination with a heterologous strain (Kuklenkova et al., 2019a, 2019b).

When carrying out immunoprophylaxis of IBC, local immunity is important, which can be ensured using a live spray vaccine – a method starting from the day old. When establishing the circulation of variant IBC virus strains on the farm, it is necessary to introduce vaccination against the variant strain into the treatment and preventive measures scheme without canceling vaccination using a vaccine containing the classic strain of chicken infectious bronchitis virus. The timing and frequency of vaccination should be determined based on the epizootic situation in the economy, as well as taking into account the results of laboratory studies (Klieve and Cumming, 1988; Cook et al., 1999). This study presents materials on the industrial use of live vaccines against infectious bronchitis of hens from a variant strain. Aim of present study was to introduce a successful protocol for specific prevention of IBC.

MATERIALS AND METHODS

Live vaccine against infectious bronchitis of chickens from a variant strain. Hisex cross-country white chickens aged 15-16 days.

Kits for the diagnosis of chicken infectious bronchitis by enzyme-linked immunosorbent assay manufactured by IDEXX. The live vaccine contains a live variant strain of the chicken infectious bronchitis virus with an activity of at least 107.5 EID50/cm² mixed with a protective environment for lyophilization in a ratio of 2:1. The vaccine was applied by the spray method (coarse-droplet spray) after 14 days the blood serum was taken from the vaccinated birds and the immunity intensity was monitored by ELISA using IDEXX kits. Veterinary indicators such as live weight, feed conversion, herd safety, and uniformity were further studied.

RESULTS AND DISCUSSION

This work aims to isolate the pathogens of infectious bronchitis of chickens circulating in poultry farms of the Russian Federation, study their biological and molecular properties, conduct genomic sequencing and develop a vaccine prevention scheme taking into account the serotypes of viruses circulating in a particular poultry farm. Studying the biological and molecular properties of the pathogens of chicken infectious bronchitis circulating in the Russian Federation makes it possible to develop a technology for the production of vaccines against chicken infectious bronchitis from variant strains with the aim of the most effective specific prevention of chicken infectious bronchitis in poultry farms.

A live vaccine against infectious bronchitis of chickens from a variant strain was used in one of the poultry farms of the Russian Federation. A live vaccine against chicken infectious bronchitis from the classic strain was included in the treatment and preventive measures scheme of the indicated poultry farm. However, respiratory symptoms decreased egg production, and shell deformation was observed in the vaccinated bird. It was proposed to change the vaccination schedule by introducing into it an additional two-time vaccination with a live vaccine against infectious bronchitis of hens from a variant strain (1 vaccination at the age of 15-16 days, 2 vaccination at the age of 70-75 days). The live vaccine against infectious bronchitis virus used from the variant strain of the virus of infectious bronchitis is free from contamination with foreign viruses, mycoplasmas, fungi, and bacteria, it is specific and active, it has pronounced antigenic activity and contributes to the development of antibodies in protective titers to the field variant strain of the virus of the chicken infectious bronchitis virus birds.

This vaccine in the period from January 01, 2012, to September 01, 2013, 30 910 800 birds were vaccinated. Poultry vaccination was carried out by the instructions for use by the spray method. The time for monitoring vaccinated birds was 30 days from the time of vaccination. Post-vaccination complications and poultry withdrawal were not observed.

Development, live weight of chickens, and feed conversion during the rearing period were within the standard parameters. Preservation for the growing period (from 1 to 110 days of life) with a planned 97.6% was 98.8 - 98.9%. The uniformity of the herds when transferred to hen - hen was 94 - 95%.

The control of immunity tension was carried out by enzyme-linked immunosorbent assay (ELISA). In the study of blood serum, titers of antibodies to the infectious bronchitis virus were established from 3651 to 7921, the coefficient of variation of CV was 23%, which indicates intense and uniform immunity. Studies of serum samples were carried out by the recommendations. The level of antibody production corresponds to the recommended level. The experimental data are presented in the Table 1.
The effectiveness of the live vaccine against infectious bronchitis of chickens presents in Figure 1. After the use of a live vaccine against infectious bronchitis of chickens from a variant strain, the development, live weight of chickens, and feed conversion during the rearing period were within the standard parameters. The safety for the growing period with a planned 97.6% was 98.8 - 99.8%. The uniformity of the herds when transferred to hen was 94 - 95%. Present findings are in agreement with Salman et al., (2019) who stated improved performance of layer-type hens after using live bronchitis vaccine. Also, in Elhady et al., (2019) using live bronchitis vaccine caused elevation of antibody titer in broiler chickens. Present study (as a complete work) show that inoculation of live vaccine against infectious bronchitis also caused improved growth performance and feed conversion ratio in chickens.

Conclusions

The control of immunity tension was carried out by enzyme-linked immunosorbent assay (ELISA). In the study of blood serum, titers of antibodies to the infectious bronchitis virus were established from 3651 to 7921, the coefficient of variation of CV was 23%, which indicates intense and uniform immunity. Post-vaccination complications and poultry withdrawal were not observed. The live vaccine against infectious bronchitis of chickens from a variant strain has a pronounced antigenic activity and contributes to the development of antibodies in protective titers in vaccinated birds.

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REFERENCES


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<th>Table 1: Comparative evaluation of the effectiveness of the live vaccine against infectious bronchitis of chickens from the variant strain.</th>
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<td>Indicator</td>
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<tr>
<td>Feed conversion per 1 kg of egg mass</td>
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