Development of an effective and stable genotype-matched live attenuated newcastle disease virus vaccine based on a novel naturally recombinant Malaysian isolate using reverse genetics

ABSTRACT

Genotype VII Newcastle disease viruses are associated with huge economic losses in the global poultry industry. Despite the intensive applications of vaccines, disease outbreaks caused by those viruses continue to occur frequently even among the vaccinated poultry farms. An important factor in the suboptimal protective efficacy of the current vaccines is the genetic mismatch between the prevalent strains and the vaccine strains. Therefore, in the present study, an effective and stable genotype-matched live attenuated Newcastle disease virus (NDV) vaccine was developed using reverse genetics, based on a recently isolated virulent naturally recombinant NDV IBS025/13 Malaysian strain. First of all, the sequence encoding the fusion protein (F) cleavage site of the virus was modified in silico from virulent polybasic (RRQKRF) to avirulent monobasic (GRQGRL) motif. The entire modified sequence was then chemically synthesized and inserted into pOLTV5 transcription vector for virus rescue. A recombinant virus termed mIBS025 was successfully recovered and shown to be highly attenuated based on OIE recommended pathogenicity assessment indices. Furthermore, the virus was shown to remain stably attenuated and retain the avirulent monobasic F cleavage site after 15 consecutive passages in specific-pathogen-free embryonated eggs and 12 passages in one-day-old chicks. More so, the recombinant virus induced a significantly higher hemagglutination inhibition antibody titre than LaSota although both vaccines fully protected chicken against genotype VII NDV induced mortality and morbidity. Finally, mIBS025 was shown to significantly reduce both the duration and quantity of cloacal and oropharyngeal shedding of the challenged genotype VII virus compared to the LaSota vaccine. These findings collectively indicate that mIBS025 provides a better protective efficacy than LaSota and therefore can be used as a promising vaccine candidate against genotype VII NDV strains.

Keyword: Newcastle disease virus; Reverse genetics; Recombinant vaccine; Genotype-matched; Genotype VII