

CHAPTER 1

Introduction

1.1 Historical background

In Vietnam, a country with a high total poultry population as well as high population density, Highly Pathogenic Avian Influenza (HPAI) subtype H5N1 has become endemic, resulting in tremendous economic losses to the poultry industry and great concerns for public health as there have been sporadic human infections since the first outbreak reported in 2003 (V. N. Bui et al., 2014; Stéphanie Desvaux et al., 2011; C. C. Tran et al., 2016). To tackle the disease, Vietnam's government initiated a national routine poultry mass vaccination program against H5 HPAI viruses in 2005, after the failure of other measures to stamp out the disease (C. C. Tran et al., 2016). Vaccination has contributed to a reduction in the number of infections and outbreaks in poultry and consequently has reducing the risk of human exposure and human cases, important steps toward prevention and control of the disease (D. E. Swayne, 2012). The Re-6 vaccine (Harbin Veterinary Research Institute, Harbin, China) has been used extensively to immunize poultry since 2014. That vaccine contains antigens with close antigenic similarity to the H5N1 virus subclade 2.3.2.1c circulating widely in southern Vietnamese provinces (Le & Nguyen, 2014) according to the Ministry of Agriculture and Rural Development – Department of Animal Health (MARD-DAH) (Dispatch No.2904/TY-DT, 2017). It is expected that the vaccine will continue to be used for the immediate future as it provides a certain protective effect against the disease in the poultry population.

Domestic ducks, which are the second largest poultry species in the country after chickens in terms of numbers, is a natural reservoir that contributes to the maintenance and spread of the H5N1 HPAI virus (Hulse-Post et al., 2005; D. E. Swayne & D. R. Kapczynski, 2008). For that reason, vaccination of ducks is part of the disease control strategy in Vietnam (Cha et al., 2013). Within Vietnam, the Mekong Delta is an area of high domestic duck density and also a high-risk area for H5N1 HPAI due to the large

number of backyard or smallholder poultry farms (X. M. Bui, 2010; Henning et al., 2011). This small-scale poultry production system has several characteristics that have made it a primarily site of HPAI virus infection. Small-scale production systems result in problems of inappropriate vaccination and result in logistical complexity for vaccinating large numbers of household flocks with relatively few birds in each flock. In addition, farm owners appear to lack sufficient knowledge of poultry diseases and, as a consequence, are less likely to comply with vaccination guidelines (D. E. Swayne, 2011).

In Vietnam, as part of the effort to achieve effective control of H5N1 HPAI through vaccination, serological post-vaccination surveillance has been carried out using the HI assay to evaluating the vaccine-induced immunity of poultry as a method of determining the field effectiveness of a vaccination course (S. Desvaux et al., 2012). This routine surveillance has been conducted biannually by randomly collecting serum samples from a variety of poultry species including chickens, ducks, and Muscovy ducks at regular intervals and for a range of poultry ages, then analyzing the data to get a picture of the current situation (MARD-DAH, Dispatch No. 487/TY-DT, 2009). Due to the overwhelming number of chickens compared to other types of poultry, results from that routine surveillance are likely to reflect primarily the chicken population (personal communication with veterinary authorities of the Sub-DAH of Ben Tre province). There are few detailed reports published about the field effectiveness of H5N1 vaccination, especially with the Re-6 vaccine, regarding the humoral immune response in domestic ducks.

Implementing an effective vaccination protocol for ducks has not been an easy task. A full-course vaccination against H5N1 HPAI with two doses of the vaccine is strongly recommended for immunologically-naïve domestic ducks. However, a review of field practice has shown that vaccination of ducks raised for meat have been conducted without proper attention. A large number of meat duck producers have not been providing a booster vaccination for their flock before finishing their short-term production cycles. In 2016, a low rate of vaccination of meat ducks with two shots in Mekong Delta region was reported by Cuong and his co-workers (Cuong et al., 2016). This may be due to the fact that vaccine manufacturer recommended a 28 day withholding period before slaughter for the two-dose vaccination regime. That does not fit well with the early finishing for meat duck production which is commonly carried out at around 63 days (i.e., 21 days for

the first vaccine, 21 days for the booster, and 28 more days withholding equals 70 days, would mean a 10% increase in the length of the production cycle). The popular single-dose vaccination in ducks raised for butchering also involves time-consuming and labour-intensive efforts and also results in stress for the ducks just prior to selling time. These facts suggest an inquiry into whether a single vaccination can induce the desired protective immune response in ducks for a certain period of time as well confirmation of the benefits of the two-dose H5N1 vaccination regime for ducks.

The aim of this field study was to evaluate the field effectiveness of an early H5N1 HPAI vaccination course with the Re-6 vaccine in immunologically-naïve domestic ducks on household farms based on an examination of the level and variation of antibody response as well as seroprotection rates following vaccination. Findings of this study may provide suggestions to national veterinary authorities for improvement of H5N1 HPAI vaccination strategy.

1.2 Objectives of the study

1.2.1 To evaluate the antibody response of ducks to one early course of HPAI H5N1 vaccination by the difference in antibody titre against the virus (measured by the HI assay) between pre- and post- vaccinations, pattern of humoral immune response after AI vaccination.

1.2.2 To define the variation and distribution of antibody titres of among individual ducks within each farm and among farms.

1.2.3 To determine the proportion of vaccinated ducks and vaccinated farm flocks showing serological evidence of protection (achieving the target antibody level according to the current national regulation).