Protection of the Reproductive Tract of Young Chicks by 
Newcastle Disease Virus-induced Haemagglutination-
inhibition Antibodies

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ABSTRACT

The present study was conducted to assess the haemagglutination-inhibition (HI) titres required to 
protect the chicken reproductive tract against direct damage caused by Newcastle disease virus (NDV). 
Precociously induced oviduct and uterus by oestrogen treatment of young chicks were used to assess the 
damage or protection against the damage by analysis of ciliostasis or histopathological lesions. 
Unvaccinated day-old female white leghorn chickens were used as the maternally derived antibody 
(MDA) group. Chickens were vaccinated with either a live lentogenic vaccine on day 14 of age or, along 
with it, an inactivated vaccine at day 36 of age, to generate birds with a range of primary or secondary 
response induced HI antibodies. Birds with different HI antibody levels were challenged with virulent 
NDV. It was found that a HI antibody titre of 128 and above was protective against direct damage of 
the reproductive tract, while the 32–64 titre range was protective when derived through secondary 
vaccination only.

Keywords: precocious oviducts, protection, haemagglutination-inhibition titres

Abbreviations: ELD50, embryo 50% lethal dose; HA, haemagglutination; HI, haemagglutination 
inhibition; MDA, maternally derived antibody; ND, Newcastle disease; NDV, Newcastle disease virus

INTRODUCTION

Economic losses caused by Newcastle disease (ND)-induced mortality or decrease in 
egg production are common in India (Ganesan et al., 1993; Mukhopadhyay et al., 
2002). This has necessitated adoption of different vaccines and vaccination schedules 
for protection of chicken against ND (Rathore et al., 1987). These vaccines generate 
different levels of haemagglutination-inhibition (HI) antibodies depending on 
maternally derived antibody (MDA) levels in vaccinated birds (Allan et al., 1978), the 
potency of the vaccine, vaccination method and breed of chicken (El Hassan et al.,
1999; Maas et al., 1999).
Protection against ND is highly correlated with the humoral antibody response commonly estimated by HI test. In some cases, cell-mediated immunity also plays a role since birds with low HI titres were also protected against challenge (Alexander, 1997). The reciprocal HI titre required to protect against mortality induced by a virulent ND virus (NDV) was about 40, while the titre required to protect against egg drop was 512 (Allan et al., 1978). However, field anecdotal evidence suggested that majority of layer flocks with lower HI titres of 64–128 also did not suffer from any drop in egg production or quality. This prompted us to re-evaluate the HI titres that are required to protect against NDV-induced damage to the chicken reproductive tract that results in drop in egg production.

Precociously induced oviducts by oestrogen treatment of young chickens have been used successfully as a model system for the study of virulence of infectious bronchitis virus (Dhinakar Raj and Jones 1996), avian pneumovirus (Kehra and Jones, 1999), egg drop syndrome virus (Dhinakar Raj et al., 2001) and NDV (Sreenivasa Rao et al., 2002).

Decrease in the egg production is a functional manifestation of pathology of the reproductive tract. All the earlier studies with NDV involving reproductive tract were done using drop in egg production or quality as the indicator of pathology of the reproductive tract (Berg et al., 1947; Knox, 1950; Chubb and Cumming, 1982). However, in the present study the actual histopathological changes induced by NDV or absence of changes due to protection by different HI antibody levels were taken as the criteria to measure protection of the reproductive tract (direct damage instead of manifestation of the damage).

MATERIALS AND METHODS

**Chickens**

One-day-old female White Leghorn chickens obtained from the Poultry Research Station, Chennai, India were used. They were reared under clean isolated conditions, and were fed and watered *ad libitum* during the experimental period.

**Viruses**

Live ND vaccine strain, the lentogenic F strain (Asplin, 1952), obtained from Institute of Preventive Medicine (IVPM), Ranipet, India, and inactivated VH strain (Nectiv, ABIC Ltd, Israel) were used on 2nd and 5th weeks of age, respectively to generate chickens with a range of HI antibody levels. The challenge virus was obtained from IVPM, Ranipet, India and used at an embryo 50% lethal dose (ELD$_{50}$) of $10^5$ per bird intramuscularly. The challenge virus had an intracerebral pathogenicity index of 1.45 and a mean death time of 48 h.