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Clinico-Pathological Features of Newcastle Disease in Japanese Quails *(Coturnix coturnix japonica)* Infected with Newcastle Disease Virus Kudu 113 Strain

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Abstract: Experiments were performed to determine whether Japanese quails (*Coturnix coturnix japonica)* are susceptible to Newcastle disease virus (NDV) Kudu 113 strain. In the experimental trials, a total 119, six weeks old Japanese quails were administered varying doses of the virus, ranging from 0.1 ml to 0.3 ml intramuscularly (im) and per os (po). The uninfected control quails were not administered the virus and were reared separately. Depression, weakness, incoordination, anorexia, ruffled feathers and paralysis of legs and wings were noted in some of the infected quails. At necropsy, some of the infected quails also had haemorrhagic enteritis and congested lungs, liver, heart and spleen and muscles of breast, thighs and legs. There was a rise in haemagglutination inhibition (HI) antibody titre in all the infected quails, following administration of NDV Kudu 113 strain either im or po. The highest mean HI antibody titre of $\log_2$ 10.56± 0.29 was obtained on day seven post infection (pi) in the group that was administered 0.3 ml of the virus im. Similarly, the highest mean HI antibody titre of $\log_2$ 9.89±0.48 was obtained on day seven pi in quails that were administered 0.3 ml of the virus po. On the other hand, the control quails were negative to HI antibody test. This study demonstrated that Japanese quails are susceptible to NDV Kudu 113 strain.

Key words: Japanese quail, newcastle disease virus and susceptibility

Introduction

Quail production has been on a large scale in many countries of the world. In Nigeria, for example, some research institutes have gone into commercial production and investigation into nutritional and disease control of quail birds (Lombin, 2007).

Quails are also ideally suited for avian research, because of their small size and require little cage space for rearing. They are easy to raise and are suitable for genetic studies since they rapidly attain sexual maturity (Khare *et al*., 1975).

Newcastle disease virus is the causative agent of a devastating poultry disease called Newcastle disease (ND). Newcastle disease is a major problem for poultry industry worldwide (Alexander, 2000; Maw *et al*., 2003; Oladele *et al*., 2005). It is considered as a major threat to poultry. As a result, ND is included in list A contagious diseases of poultry by the Office International des Epizooties, this has form the basis for its economic and veterinary importance (Alexander, 2000).

Newcastle disease virus comprises a variety of strains distributed worldwide that differ widely in virulence for avian species (Gould *et al*., 2003; Sa'idu *et al*., 2006). Chickens infected with NDV, for example, may show clinical signs, varying from extremely mild respiratory or enteric disease (avirulent strains) to severe systemic infection, resulting in high mortality (virulent strains) and characterized by very rapid spread (Alduos *et al*., 2003; Oladele *et al*., 2005).

It is established that NDV can infect a variety of domestic and wild birds and induce enormous variations in the severity of disease and lesions (Alexander, 2000; Maw *et al*., 2003; Sa'idu *et al*., 2006). But in quails, it has been previously observed that when challenged with NDV they did not come down with clinical signs of ND, even though the virus circulates in the body systems of the quails (Higgins and Wong, 1968; Higgins, 1971; Lima *et al*., 2004). Since the pathogenicity of NDV depends chiefly on the strain of the virus, its dose and route of administration, it therefore, becomes imperative to determine whether the development of clinical signs of ND in quails could also depend on the strain of NDV, its dose or route of administration. This study was carried out to determine the susceptibility of quails to NDV by varying the dose and route of administration of NDV Kudu 113 strain.

Materials and Methods

Quails and management: A total of 119 Japanese quails *(Coturnix coturnix japonica)* were obtained at six weeks old from National Veterinary Research Institute (NVRI), Vom, Plateau State, Nigeria. The quails were randomly selected into seven groups of 17 quails per group. Quails in each group were kept in different cages. Water and feed were supplied *ad libitum*.

Newcastle disease virus inoculum and challenge of the quails: Newcastle disease virus Kudu 113 strain was obtained from NVRI. The virus was isolated from free-roaming ducks in Kuru, Plateau State of Nigeria (Echeonwu *et al.,* 1993). The virus was considered velogenic because of the following pathogenicity indices: Intracerebral pathogenicity index, 1.56; mean lethal dose, $\log_{10}$ 8.00; mean death time, 49.60h; intravenous pathogenicity index, 2.18; embryo infective dose 50% end point per ml, 8.46; percentage adsorption of chicken brain cell, 97.66%; thermostability of haemagglutinin at 56°C, 120min; and virus elution rate, > 26h.

At six weeks of age, the quails were administered different doses of NDV Kudu 113 strain as follows:

Group 1 was administered 0.1ml of the virus per os (po)
Group 2 was administered 0.2ml of the virus po.
Group 3 was administered 0.3ml of the virus po.
Group 4 was administered 0.1ml of the virus intramuscularly (im).
Group 5 was administered 0.2ml of the virus im.
Group 6 was administered 0.3ml of the virus im.
Group 7 was the control group. No virus was administered to quails in this group.

None of the quails both in the infected or control group had previously received NDV vaccines.

Clinical and pathological examination: Quails in the infected and control groups were observed daily for clinical signs of ND. Dead quails were necropsied and examined for gross lesions in the spleen, liver, kidneys, lungs, heart, intestine, proventriculus, trachea, brain and breast and thigh muscles.

Blood sampling and serology: Blood sampling started a day before infection, through to days 3, 7, 14, 21 and 28 pi. The blood samples were collected through wing venepuncture, using 25-gauge sterile hypodermic needles and syringes. Sera for each day from each quail were used to determine HI antibody titres by the procedures of Beard (1989). The sera were stored at -20°C until they were used for HI analysis.

Results and Discussion

Some of the infected quails developed ND. Obvious clinical signs started day four pi. The first sign was a decrease in activity, resulting in apathy and depression. Other signs observed were weakness, incoordination, anorexia and ruffled feathers (Fig. 1). Ataxia and paralysis of the legs and wings (Fig. 2) were also observed in quails inoculated with 0.3 ml of the virus im. On the other hand, the control quails were active and alert throughout the experimental period (Fig. 3).

At necropsy, the infected quails had evidence of dehydration, weight loss, congestion of muscles of the breast, thighs and legs. The heart, spleen, lungs and liver were also congested. Haemorrhagic enteritis was also observed (Fig. 4).

Fig. 1: Photograph of quails infected with NDV Kudu 113 strain. Note the signs of depression, weakness and ruffled feathers.

Fig. 2: Photograph of quail infected with NDV Kudu 113 strain. Note the sign of paralysis of the legs and wings.

The results indicate that the lesions of ND in the experimental infected quails in this study were characterized by pathological lesions similar to those previously observed in chickens (Cheville *et al.*, 1972; Alexander and Parsons, 1986; Lam, 1996; Sa'idu *et al.*, 2006). These results contradict the findings of previous authors (Higgins and Wong, 1968; Higgins, 1971; Lima *et al.*, 2004) who did not find any sign of ND in quails infected with NDV.

In this study, only mortality of 3% was recorded in the infected quails. It is, however, not clear why NDV Kudu 113 strain which produced mortality of over 50% in chicken administered 0.2 ml of the virus im (Echeonwu *et al.*, 1993; Oladele *et al.*, 2005) had so low mortality in quails. This finding could be as a result of host differences in response to NDV and the virulence of NDV strain, as previously observed by Alexander (2000) and Maw *et al.* (2003).

Only quails inoculated with 0.3ml of NDV Kudu 113 strain im showed neurological signs. This finding is in line with the result of Beard and Hanson (1984) who

Fig. 3: Photograph of control quails. Note that the quails were active and alert

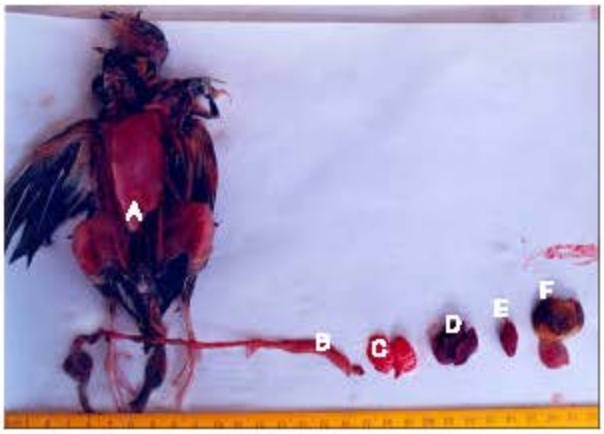

Fig. 4: Gross pathological changes in quail which died of ND caused by NDV Kudu 113 strain infection. Note the emaciation and congestion of the muscles of the breast and thighs on the carcass (A); haemorrhagic enteritis (B); and congestion of the lungs (C), liver (D), heart (E) and gizzard (F).

found that intramuscular or intravenous routes of NDV infection appear to enhance neurological signs, while natural routes of infection (nasal, oral and ocular) appear to emphasize the respiratory nature of the disease (Beard and Easterday, 1967; Alexander, 2000). Although some of the quails administered varying doses of NDV Kudu 113 strain po showed clinical signs of weakness and depression, severe respiratory signs with nasal discharges and greenish diarrhoae common in ND (Mishra *et al.*, 2000; Barbezange and Jestin, 2003) were not observed in this study.

All the quails were tested for the presence of HI antibody titre before the experimental trials and they were found negative by HI test. As a result, they were considered free of ND. However after infection, the various groups of quails which receive NDV Kudu 113 strain im or po began to experience a rise in HI antibody titre pi. The highest mean HI antibody titres of $\log_2$ 10.22 ± 0.27, $\log_2$ 10.44 ± 0.24 and $\log_2$ 10.56 ± 0.29 were obtained from quails which were administered 0.1 ml, 0.2ml and 0.3ml of the virus im, respectively on day seven pi. Similarly, the highest mean HI antibody titres of $\log_2$ 9.78 ± 0.46 $\log_2$ 9.78 ± 0.49 and $\log_2$ 9.89 ± 0.48 were obtained from quails which received 0.1ml, 0.2ml and 0.3ml of the virus po, respectively. These values were also obtained on day seven pi.

In general, the serological response of quails to NDV Kudu 113 strain reported here was high (maximum mean titre of $\log_2$ 10.56 ± 0.29), but late (seven days after infection), when compared with the result obtained in chickens infected with the same virus (Oladele *et al.*, 2005). Variations in the values and time of maximum HI antibody titre between these two types of birds may be due to a number of factors, such as host differences, immune status of the birds and laboratory storage conditions of the virus (Mishra *et al.*, 2000; Barbezange and Jestin, 2003).

It was concluded that Japanese quails are susceptible to NDV Kudu 113 strain and the susceptibility of the quails to the virus depends among other things, on the strain and dose of the virus.

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