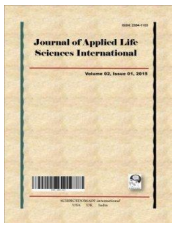

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Effect of Route of Administration on Immune Response of Broiler Chicks to Newcastle Disease Vaccine (LaSota)

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Authors' contributions

This work was carried out in collaboration of all authors. Authors MES and MCOE designed the study. Author MES wrote the protocol, wrote the first draft of the manuscript, managed the literature searches, analyses of the study and performed the Haemagglutination Inhibition analysis and author BMA managed the experimental process offered helpful comments and critical review of the paper. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This work was undertaken to study the immune response of broiler chicks to LaSota vaccine by using different routes of administration.
Study Design: The design used was a completely randomized design.
Place and Duration of Study: The study was carried out at the Poultry Unit of the Kogi State University Teaching and Research Farm Anyigba, Kogi State, Nigeria. It lasted for 5 weeks.
Methodology: One hundred day old broiler chicks were grouped into 4 of 25 chicks each (A, B, C and D). In the 3rd week of life, the groups were vaccinated with LaSota by intraocular (i/o), intramuscular (i/m) and oral (per os) routes respectively while Group D served as the unvaccinated control group. Five chicks from each group were randomly selected and bled at 2, 3, 4 and 5 weeks post LaSota vaccination. Their sera were used for Haemagglutination Inhibition (HI) test.
Results: All the routes used produced high levels of Haemagglutination Inhibition (HI) antibody

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titres two weeks post vaccination. Immunity fell below protective level after 5 weeks post vaccination

Conclusion: All the routes in this study were immunogenic and vaccination failure may not necessarily be due to the route of administration of vaccine.

Keywords: Newcastle disease; immunity; LaSota; broilers; vaccination; routes.

1. INTRODUCTION

Newcastle Disease (ND) is a contagious viral disease of poultry and wild and caged birds. ND is a threat to the poultry industry and to rural poultry rearing globally [1-3]. ND causes increased morbidity and mortality and loss of eggs for both breeding and human consumption [3]. There are several reports of ND outbreaks even among vaccinated populations. Aldous and Alexander [4] also reported cases of vaccination failures in ND vaccinated birds.

Newcastle Disease is a worldwide recognized disease caused by the Newcastle disease virus also known as avian paramyxovirus 1 which is categorised into 3 pathotypes namely, the lentogenic (mildly pathogenic), mesogenic (moderately pathogenic) and velogenic (virulent and highly pathogenic) strains [5,6].

Even countries that were for a long time said to be 'free' from ND have reports of outbreaks of ND. Examples include, The Netherlands which had ND outbreaks in 1992 – 1993, the United Kingdom had ND outbreak in 1997 and the United State of America in 2002 [7].

Newcastle disease is endemic in Nigeria [8] and has been the most important disease of chickens in Nigeria [9]. ND has no cure and vaccination and biosecurity are the major measures of control [9].

Newcastle disease. Vaccines can be given intraocularly, intramuscularly or in drinking water depending on the reconstitution of the antigen. Cargill and Johnston [10] suggested that poor administration practice is the most common cause of vaccination failure in poultry.

It is reported that it is very important to follow the route of administration of any vaccine as prescribed by the manufacturers [11].

Generally, methods of vaccine administration as recommended by Cargill and Johnston [10] include through drinking water, by spray/ nebulisation, by eye drop and by injection (intramuscular or subcutaneous).

Despite the ND vaccines and vaccination programs, ND outbreaks are still rampant [12]. One of the reasons for vaccination failure in poultry is when live vaccines become inactivated due to improper handling or administration as explained by Anjum [13]. In view of this, this work was undertaken to study the immune response of broiler chicks to LaSota by using different routes of administration.

2. MATERIALS AND METHODS

The study was carried out at the Poultry Unit of the Kogi State University Teaching and Research Farm, Anyigba, Kogi State, Nigeria. Anyigba is located in the derived savannah zone of Nigeria on latitude 7° 30' N and longitude 7° 09'E.

One hundred broiler chicks were used for this study. Commercial feed and water were given *ad libitum.* The birds in each group were raised in deep litter systems in separate rooms. At the age of 8 days, the 100 chicks were given primary vaccination with Hitchner B1 strain intraocularly using the National Veterinary Research Institute (NVRI) brand. In the 3rd week of life, they were randomly divided into 4 groups of 25 chicks each and the groups were vaccinated with NVRI brand of LaSota as follows:

- Group A received 0.05 mL LaSota intraocularly (i/o) per eye
- Group B received 0.2 mL LaSota intramuscularly (i/m)
- Group C received 200 mL LaSota in drinking water (per os) after reconstituting 200 doses in 2 litres of water
- Group D served as the unvaccinated control.

Other routes of vaccination include intranasal and use of spray mechanism. These were not used in this research because LaSota was not recommended to be used through these routes by the manufacturer and to prevent vaccine

wastage due to the limited number of birds in the study.

At 2 weeks post LaSota vaccination, five birds from each group were bled and their sera used for Haemagglutination Inhibition (HI) test as described by [14]. This was repeated at 3, 4 and 5 weeks post vaccination. Means of the HI titres results were transformed to $\log_{10}$ and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS 15.0). Animal care and handling were done according to the ethical guidelines by the Institutional Animal Ethics Committee [15].

3. RESULTS AND DISCUSSION

Immune response of chicks to NDV (LaSota) vaccine by different routes was uniform ($P > 0.05$). The HI titre results (log transformed) are as shown in Table 1.

Results of the study showed that NDV (LaSota) vaccination using either i/o, i/m or per os route produced high levels of immunity and the titres of the vaccinated groups were higher ($P<0.05$) than the unvaccinated group. Therefore, vaccination failure reports in Nigeria may not be necessarily due to the routes used.

It was suggested by McMullin [16] that methods of administration (routes) may affect vaccine efficiency. However, in this study, the 3 routes employed gave high levels of immunity. Other factors may therefore be responsible for vaccination failure among vaccinated flocks in the country.

The normal protective level of ND in chicks is HI titre 32 (i.e. log transformed 1.51). Since the titre dropped below the protective level i.e. HI titre 32 (1.51) at week 5, an immunostimulant may be required in feed or water to boost the immunity of vaccinated birds.

However, some of the reasons for vaccination failure may include:

i. High levels of maternal antibodies in young chickens which interfering with the multiplication of live vaccines, thus reducing the amount of immunity produced [17]
ii. Stress which reduces the chickens' ability to mount immune response. Stress could include environmental extremes (temperature, relative humidity), inadequate nutrition, parasitism and other diseases [18].
iii. Inactivation of live vaccines due to improper handling such as not maintaining cold chain [19].
iv. Use of vaccines that do not contain the proper strains or serotypes of organisms required to stimulate protective immunity.
v. Poor distribution of live vaccine in drinkers when administered by water or improper spray of vaccines such that chickens are 'missed' in parts of the house [20].
vi. Vaccination of chickens that are already incubating the disease.
vii. Immunosuppression due to infection with infectious bursal disease virus, Marek's disease virus or chick anaemia virus, consumption of feed with high levels of mycotoxins [20].
viii. Use of vaccines that are of poor quality (low vaccine titre or contaminated). McMullin [16] explained that one major factor affecting vaccine efficiency is the vaccine itself – its titre, stability, serotype, quality, inactivation and adjuvants.

Table 1. Mean Newcastle disease HI (log transformed) titres of broiler chicks vaccinated with LaSota using different routes

Weeks post vaccination	Group A i/o (HI titre)	Group B i/m (HI titre)	Group C p. os (HI titre)	Group D control (HI titre)
2	1.87 ± 0.11^{b}	1.99 ± 0.12^{b}	1.93 ± 0.34^{b}	0.96 ± 0.06^{a}
3	1.44 ± 0.18^{b}	1.63 ± 0.15^{b}	1.26 ± 0.39^{b}	0.24 ± 0.15^{a}
4	1.20 ± 0.20^{b}	1.44 ± 0.11^{b}	1.20 ± 0.34^{b}	0.00 ± 0.00^{a}
5	0.78 ± 0.20^{b}	1.02 ± 0.31^{b}	1.20 ± 0.32^{b}	0.00 ± 0.00^{a}

Different superscripts along a row indicate significant difference ($P < 0.05$)

4. CONCLUSION

All the routes in this study were immunogenic and vaccination failure may not necessarily be due to the route of administration of vaccine. Other factors like heat, cold and or management stress may be involved among others.

ETHICAL APPROVAL

All authors hereby declare that "Principles of laboratory animal care" in Nigeria were followed, as well as specific national laws where applicable. All birds used were treated humanely according to the ethical guidelines by the Institutional Animal Ethics Committee [15].

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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