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Field Evaluation of Immunogenicity of Five Commercial Vaccines Against Newcastle Disease in Poultry Farms in Ibadan, Nigeria

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ABSTRACT

This study was conducted to evaluate immunogenicity of five commonly used vaccines for prevention of Newcastle disease (ND) in Ibadan, the capital city of Oyo State Nigeria. Two hundred and twenty (220) blood samples were collected from apparently healthy vaccinated chickenin 8 poultry farms in suburbs of the city. An average of 27 samples was collected from each farm.Blood samples were collected from a total of 72 breeders 88 layers and 60 pullets. Sera were testedusing heamagglutination inhibition (HI) techniquet to determineantibody levels against ND after vaccination with a commercial ND vaccine. Geometric mean titre (GMT) of antibodies against ND were calculated among flocks. The resultsindicated significant ($p<0.05$) difference between the vaccines used. Highest level of immunity was confered by an imported LaSota vaccine (VAC 2),while lowest immunity was confered by another imported LaSota vaccine (VAC 1).The present findings indicate that some imported ND vaccines may effectively serve as alternative to the locally produced vaccines. Routine sero-monitoring ofpoultry response to ND vaccinesis advocated to enable farmers monitor immune profile of their flocks may contribute to more effective and efficient control of ND and ensure economic performance of farms. This facility could be part of the services in State Veterinary Laboratories in Nigeria.

KEY WORDS: Hemaglutination-inhibition test, Newcastle disease, seromonitoring, vaccine efficacy.

INTRODUCTION

Newcastle disease (ND) also called Avian Distemper or Velogenic Viscerotropic Newcastle Disease (VVND) is an acute infectious and highly contagious disease (Ohore *et al.*, 2002) with the potential of causing 100% morbidity and mortality in unvaccinated poultry (Chakrabarti *et al.*, 2006). The disease has both epizootic and enzootic patterns in different flocks or population but, it is an epizootic in intensive poultry and is responsible for most economic losses associated with poultry production (Awan *et al.*, 1994). The occurrence of highly virulent NDV infections are recognized as a notifiable disease reportable to the Office of International Epizooties (Agbede *et al.*, 1992) and is one of the main sanitary barriers for the free trade of poultry and poultry products (OIE, 1996, Chitate and Gutal, 2011). It is of great economic importance causing devastating losses among both intensive, extensive poultry birds and traditional village poultry that provides lifeline to many poor people across the developing world (Anon, 2010).

Newcastle disease had been present in

Nigeria since 1951, and ever since, it's still occasionally occurs in epidemic proportions. A seasonal variation has been observed in the incidence of the disease in the country with more outbreaks occurring in the dry season between October and March (Onunkwo and Momoh, 1981, El-Yuguda *et al*. 2004). Apart from pathogenic Avian Influenza, ND is a most dreaded disease of poultry industry in Nigeria (Echeonwu and Iroegbu, 1993).

In the control of this disease bio-security and hygiene measures are very essential in the prevention of the introduction or the spread of the disease. Such measures include: quarantine (Alexander 2001; Alexander *et al.,* 2004; Anon, 2010), restriction of movements, isolation of sick birds, vaccination (Anon, 2010), destruction of birds infected with ND, resting the contaminated environment, proper litter disposal, destruction of pests, use of disinfectants for cleaning all surfaces, equipment and vehicles, use of bird-proofed houses, food stores and water tanks, provision of clean clothing and cleansing facilities for employees, maintenance of all-in, all-out philosophy of flock management, keeping pet birds out of the farm, education of farmers, well-manned poultry extension service (Alexander *et al.,* 2004, Anon, 2010).

In addition to bio-security measures, vaccination is an important effort towards the control of ND(Alexander 2001). The use of viable non-pathogenic isolates of Newcastle disease virus to immunize poultry against pathogenic strains of the virus has been a common practice since the B1 strain was first described in 1948. Numerous ND virus with different levels of pathogenicity have been used to achieve desired immunologic response (Beard *et al.,* 1992), using different vaccination regimes (Emikpe *et al.* 2007).

The different types of vaccines commonly used include live, killed and inactivated vaccines. Vaccines containing inactivated ND virus in oil emulsion adjuvant do induce long term protection against viscerotropic velogenic ND so also live vaccines such as LaSota strains, Hitchner B1 and Komarov have gained acceptance by poultry producers in several countries (Nishizawa *et al.,* 2007). Thermostable Newcastle disease vaccines, given to village flocks had substantially protected the flock against ND (Alexander 2001; Anon, 2010). Despite rigorous vaccination programs, outbreak of ND are often reported in vaccinated as well as unvaccinated flocks. Outbreaks in vaccinated flocks are thought to be due to faulty administration (including administration by quacks), handling of the vaccines due to transport difficulties, high ambient temperatures, lack of refrigeration (Mgomezulu *et al.,* 2009), low immunogenicity of the vaccine, non-relatedness to the field strain, poor management of flocks or the presence of inter-current disease. In Nigeria, where there is little information as to the efficacy of most commonly employed ND vaccination regimes, farmers tend to repeat vaccination at relatively short intervals due to uncertainty of protective immune profile. The need toevaluate the field situation as regards the effectiveness of some available ND vaccines in the market is expedient. The aim of this study is to compare post-vaccination serum antibody level of different ND vaccines.

MATERIALS ANDMETHODS

Study areas

This study was conducted between April and June, 2011. Study areas were farms in suburbs of Ibadan, capital city of Oyo State (Latitude 7° 23' N and Longitude 3° 56' E). The main hub of the poultry industry in Nigeria is located within the south-western

states of the country (Oyo, Osun, Ogun and Lagos). Ibadan is a major central city in the south-western hub. Thus, the city is important in the national production and distribution of most poultry commodities, ranging from chicks to point-of-lay pullets, spent layers, commercial broilers and poultry inputs such as drugs, vaccines and feed ingredients. The city has 11 local government areas (LGAs). Five of these are in the main city and 6 are in the suburbs. Most poultry production activities take place in the suburb LGAs of Akinyele, Ido, Oluyole, Ona Ara, Egbeda and Lagelu (OLUWOLE et al., 2012).

Sampling of poultry farms

Only poultry farms within the suburb LGAs of Akinyele, Ido, Oluyole, Ona Ara, Egbeda and Lagelu were included in this study. This purposive selection was used to focus the study on areas within Ibadan that were well known for large number of poultry farms. There were an estimated 320 poultry farms within the 6 LGAs combined. Most of these poultry farms were not registered with Oyo State Branch of Poultry Farmers Association of Nigeria. The poultry farms in the catchment area were stratified into commercial and breeder stock categories. Stratified simple random sampling method was used to select the farms surveyed in each category (stratum). Thus, only one or two farms were targeted from each LGA for blood collection in flock. Flocks A and Bwere from two farms in Lagelu LGA, flock Hwas from a farm in Egbeda LGA, FlockFwas from a farm in Ido LGA, flocks C and D are fromtwo farms in Oluyole LGA while flock G was from a farm in Onaara LGA and flock E was froma farm in Akinyele LGA (Table I).

Poultry management and types of vaccines used

Management systemswere uniformly battery cage for layer birds and deep litter for breeders. Pullets were on deep litter system. Ages of birds varied from 4 months in pullets and average of 10 months in layers to 24 months in breeders. The five vaccines investigated are identified as VAC1 to VAC5. VAC1 is an imported, live freeze-dried vaccine brand of La Sota indicated for the immunization of fowls againstND by administration in the drinking water, by spray or by eye-drop or nasal instillation. The farms investigated used the oral method of administration.VAC2 is an imported, live freeze-dried vaccine, a secondbrand of LaSota (B) (Table I). VAC3 is imported attenuated live-vaccine, a brand of Komarov prescribed as safe when given to birds not less than six weeks of age. Each dose of0.5 ml VAC3 was inoculated intramuscularly (I/M). VAC4 is the third brand of imported LaSota (C). VAC5 is local brand of Komarov ND vaccine.

Route of blood collection

Blood samples were obtained through wing veno-puncture. About 1.5 - 2.0 ml of blood was aseptically collection from each bird and delivered into 5ml plain sample bottle. Blood was allowed to clot and serum was separated and stored at -4°C in eppendorff tube until tested. Blood samples were collected from a total of 220 apparently healthy birds. On the average, 27 samples were collected from each farm.The sample size comprised 72 breeders 88 layers and 60 pullets.

Haemagglutination Inhibition (HI) Test

Haemagglutination Inhibition (HI) test was performed according to the method described by Thayer and Beard (1988). The HI titre was the reciprocal of the highest dilution of serum which completely inhibits haemagglutination (Alexander *et al.,* 2004). HI test is based on the principle

that the haemagglutinin on the viral envelope can bring about agglutination of chicken red blood cells (RBC) and this can be inhibited by specific antibodies to ND virus antigen. HI remains a sensitive and specific test, and comparable to Enzyme Linked Immunosorbent Assay that is also commonly used (Alexander *et al.,* 2004). The Geometric Mean Titres (GMT) of the flocks was determined and vaccines used for the flocks were compared using student T-test statistics.

RESULTS

Sera from different farms gave varied antibody titres on HI test.Flock E gave highest antibody titre (3.0) followed by flock C (2.7). FlocksC, D and E however gave the highest level of immunity (100%) followed by flock G (78%) (Table II). Flock A had the least mean antibody titre (0.24) and the lowest level of immunity (0%). Flock Ehad the highest modal antibody titre (3.0).

The interval between the date of last ND vaccination and the time of blood sample collection was however not the same for all the samples. For flock E, both the antibody titre, the modal antibody titre and percentage immunity (2.71, 3.01 and 100% respectively) were still high in spite of the fact that the flocks had the longest time interval between the last vaccination and date of sample collection (Table I). The GMT of the flocks was also compared based on the vaccine brand used since different brands of ND vaccines were used to prevent the disease in the different flocks.

DISCUSSION

This investigation showed that all the vaccines commonly used for the control of ND in Nigerian poultry are immunogenic (Emikpe et al., 2007), however the titre varied with some vaccines yielding exceptionally higher antibody titre than

Table I:
Number of birds sampled,their age groups, management systems and post-vaccination interval before assessment of ND antibodies among poultry farms in Ibadan, Nigeria

Farm Identification and location	A	B	C	D	E	F	G	H
	Lagelu	Lagelu	Oluyole	Oluyole	Akinyele	Ido	Onaara	Egbeda
Vaccine Used	VAC 1	VAC 1	VAC 2	VAC 2	VAC 2	VAC3	VAC4	VAC 5
Flock Type	Pullets	Layers	Layer Breeder	Layer Breeder	Layers	Layers	Broiler Breeders	Pullets
Management System	Deep Litter	Battery Cage	Deep Litter	Deep Litter	Battery Cage	Battery Cage	Deep Litter	Deep Litter
VaccinationDate(2011)	May 30	March 5	June 15	June 15	March 29	May 27	June 02	June 20
Sample Collection Date(2011)	July 11	July 11	July 13	July 13	July 21	July 12	July 13	July 11
Time Interval (Days)	42	128	29	29	114	49	42	21
Bird Age at sample collection (Weeks)	13	68	75	75	42	36	39	14
Number of Samples	30	27	24	24	26	27	24	30

Table II:
Brands of Newcastle disease vaccine and post vaccination haemagglutination inhibition antibody levels amongchicken from eight poultry farms in Ibadan, Nigeria

Flock Identification	A	B	C	D	E	F	G	H
Mean Antibody Titre	1:2.5	1:210.9	1:552	1:348	1:535	1:243	1:224	1:86.7
GMT (±SD)	0.24(0.19)	0.89(1.33)	$2.65^{a,b}$ (0.31)	2.50^{a} (0.26)	2.71^{b} (0.35)	2.22 (0.403)	2.15 (0.315)	1.38 (0.84)
Mode (log_2)	0	0	2.7	2.4	3.01	2.4	2.1	1.5
Percentage Inhibition (%)	0	32	100	100	100	72	78	19
Vaccine Used	VAC 1 imported LaSota A	VAC 1 imported LaSota A	VAC 2 imported LaSota B	VAC 2 imported LaSota B	VAC 2 imported LaSota B	VAC3imported Komarov	VAC4imported LaSota C	VAC 5local Komarov

GMT with superscripts are significant in value (P<0.05)

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