

EVALUATION OF MATERNALLY-DERIVED ANTIBODIES AGAINST NEWCASTLE DISEASE VIRUS IN DAY-OLD CHICKS IN ABEOKUTA, OGUN STATE

¹E.B. JACOBS, ²A.A. OWOADE, ³M.A. OYEKUNLE, ¹A.O. TALABI, ¹O.O. ONI

¹Department of Veterinary Medicine and Surgery, Federal University of Agriculture, Abeokuta. Postcode 110001. Nigeria

² Department of Veterinary Medicine, University of Ibadan, Oyo State, Nigeria

³Department of Veterinary Microbiology and Parasitology,
Federal university of Agriculture, Abeokuta. Nigeria.

Corresponding author: enijacobs@yahoo.com

ABSTRACT

High maternally-derived antibodies (MDA) against Newcastle disease virus (NDV) in chickens can interfere with active immunity at early age. This study was conducted to assess the titre of MDA in chicks against NDV from two poultry breeder farms. Twenty-six blood samples were collected from day-old chicks randomly selected from two poultry breeding farms and forty blood samples were collected from the parent stocks of the same farms. The vaccination record of the parent stocks were collected while the antibody titres of the birds were estimated using Haemagglutination Inhibition (HI) test. The geometric mean titre (GMT) of MDA against NDV in chicks from Farms 1 and 2 were $\log 2^{7.2}$ and $\log 2^{7.4}$ respectively while the parent stocks from Farms 1 and 2 had $\log 2^{7.7}$ and $\log 2^{7.9}$ HI units. The percentage of chicks from Farms 1 and 2 with MDA titre above protective level ($\geq \log 2^3$) were 90% and 100% respectively. It was concluded that MDA titres against ND virus was high in the chicks therefore vaccination at day one in the hatcheries and farms should be done after the immune status of the chicks are known since high MDA titre during vaccination neutralizes vaccine virus preventing active immunity.

Key words: Titre, Newcastle disease virus, Maternally-derived antibody, chicks

INTRODUCTION

Newcastle disease (ND) is a viral disease of both poultry and non- poultry birds. It is an acute, infectious and highly contagious disease caused by Newcastle Disease Virus (NDV) of the family *Paramyxoviridae* and genus *avulavirus* (Arshad *et al.*, 1988; Al-Zubeedy, 2009). Clinical signs that accompany its infection in birds include respiratory distress, greenish watery diarrhoea, neurologic signs and sudden death

(Alexander, 2001).

Newcastle disease (ND) is endemic in Nigeria (Saidu *et al.*, 1998) with the greatest constraints to the development of poultry production (Dipeolu *et al.*, 1998) causing devastating losses in both susceptible commercial and domestic birds (Saliu *et al.*, 2009) through increased morbidity and mortality rates in affected flocks (Manchang *et al.*, 2004). Vaccination has been the major

method of preventing this disease. In Nigeria and in most part of the world, vaccination is done at day one in the hatchery and then repeated later in the bird's life.

In the chick's normal system, the maternally-derived antibody (MDA) help with initial fight against microorganism before active immunity system is activated. However, it has been reported that the presence of high level of MDA interferes or suppresses the ability of the young chick to actively respond to early vaccination (Chu and Rizk, 1975; Awang *et al.*, 1992; Goddard *et al.*, 1994). The influence of MDA on NDV replication was also reported by Westbury (1984), where he found out that MDA levels $\geq 2^{2.6}$ significantly suppressed the antibody response following vaccination but MDA levels $< 2^{2.5}$ had no deleterious effect. This will expose the birds to early infection as the birds will not be well protected.

In this study, the MDA of day-old chicks were evaluated to determine the immunological status of the birds against ND before vaccinating.

MATERIALS AND METHODS

Experimental birds

A total of twenty-six day-old chicks whose parents were vaccinated against Newcastle disease (ND) were collected from two Farms from Abeokuta, Ogun State and reared in the poultry house of the Department of Veterinary Medicine and Surgery, Federal University of Agriculture Abeokuta (FUNAAB), Ogun State. The chicks were not vaccinated against ND at day 1.

Experimental design

A total of forty blood samples (twenty each per farm) were collected from the parent

stock of two farms while twenty blood samples were collected from chicks (ten per farm) of the same farms from the Jugular vein. Sera were separated as per methods described by Samad (2005) and stored at -20°C until used. All the sera samples were tested by HI test for determination of ND antibody titres. The vaccination schedule against ND of the farms was also recorded.

Newcastle disease vaccine

Lyophilized Newcastle Disease Vaccine (Lasota strain) produced by the National Veterinary Research Institute Vom, Jos plateau State was the source of antigen used for HI test.

Haemagglutination (HA) test

The HA test was carried out as per the modified method described by Allan and Gough (1974) to determine 4HA unit. Briefly, 50 μl of PBS was dispensed into the 12 wells of the row A of a 96-well microtitre plate. Then 50 μl of NDV vaccine suspension was added to the first well, after thorough mixing serial dilution was continued up to the 11th well of the row A and finally 50 μl solution was discarded from well 11. Finally, 50 μl of 0.5% chicken red blood cells suspension was added into each well of the row A. This was repeated for wells of rows B and C. The end point of the HA activity was considered to be the highest dilution of the antigen in which positive pattern of agglutination of RBC was present. The HA titre was calculated as the reciprocal of the highest dilution of antigen in which positive pattern of HA was present.

Haemagglutination inhibition (HI) test

The HI test was conducted following the β -method as described by Allan and Gough (1974). Briefly, 50 μl of PBS was dispensed into the 12 wells of the row A of a 96-well

microtitre plate. 50µl of serum was then added and serially diluted to well 11 and finally 50µl solution was discarded from well 11. Fifty (50) µl of NDV vaccine of 4HA unit was added into each well of microtitre plate containing the serum-virus mixture and incubated at room temperature for about 5 minutes. In each well, 50 µl of 0.5% RBC was then added and mixed by shaking then incubated at room temperature for about 30 minutes. The serum end point was then determined by recording the highest dilution of serum, which inhibited the agglutination activity of RBC by the vi-

rus. The antibody titre of serum of each chicken was calculated by the reciprocal of the highest dilutions of serum end point in the HI test.

Statistical analysis

One-way ANOVA was done to determine significant difference among the groups which was vaccinated once. In both cases, means were separated by least significant difference test. All the analyses were performed using SPSS version 13.0 for Windows (Coakes *et al.*, 2006).

RESULTS AND DISCUSSION

Table 1: Vaccination Record of the Parent Stocks from the Three Farms

Farms	Age at which blood was collected (week)	Time of last vaccination (week)	Type of vaccine used	Interval between last vaccination and collection of samples (week)
1	41	37	LaSota	4
2	46	40	LaSota	6

Table 2: Summary of ND-HI Titre of Parent Stocks and Chicks from the Two Farms

Farm	Birds	Group	HI titre (log 2)												Total
			0	1	2	3	4	5	6	7	8	9	10	11	
1	Parents	No. of birds	0	0	0	0	0	0	1	1	4	11	1	2	20
		%	0	0	0	0	0	0	5	5	20	55	5	0	100
	Chicks	No. of birds	0	0	0	1	0	0	2	2	3	1	1	0	10
		%	0	0	0	10	0	0	20	30	20	10	10	0	100
2	Parents	No. of birds	0	0	0	0	0	4	1	2	5	3	3	2	20
		%	0	0	0	0	0	20	5	10	45	15	15	10	100
	Chicks	No. of birds	0	0	0	0	0	1	0	7	7	0	1	0	16
		%	0	0	0	0	0	6.25	0	43.25	43.25	0	6.25	0	100

Table 3: Geometric mean titre of antibodies against Newcastle Disease in Parent stocks and chicks from the two farms

Farm	Geometric Mean Titre	
	Parent Stock	Chicks
1	Log 27.7	Log 27.2
2	Log 27.9	Log 27.4

In this study, the GMT of MDA against Newcastle Disease Virus (NDV) of the chicks from Farms 1 and 2 were Log 27.2 and Log 27.4 respectively at day 1. From the result of the findings in this study, the GMT of MDA against NDV in the chicks from farms 1 and 2 were high enough for protection as reported by Jalil *et al.* (2009).

The difference in the titre of MDA against NDV in the chicks from the two farms may be due to differences in the vaccination schedules of the parent stock from the two farms. The parent stocks from Farm 1 were 41weeks old and were vaccinated at 18weeks with oil-based NDV vaccine and given monthly oral booster dose of NDV live vaccine while those in Farm 2 were 46weeks old and were last vaccinated when they were 40weeks old with a live NDV vaccine.

High levels of MDA interferes or suppresses the ability of the young chick to actively respond to early vaccination (Chu and Rizk, 1975; Awang *et al.*, 1992; Goddard *et al.*, 1994 and Kumar *et al.*, 2000), thus different researches have been carried out to determine the titre of MDA that can interfere with active immunity. Westbury *et al.* (1984) and Underwood *et al.* (2004) reported that MDA higher than log 2^{2.5} HI unit will interfere with active immunity

(vaccination). Considering the results from these farms, majority of the chicks from the two farms had MDA high enough to interfere with active immunity and should not be vaccinated at week 1.

In trying to prevent an outbreak of ND on their farms, most farmers in Nigeria, vaccinate their birds from day 1 and keep repeating at intervals until the oil based NDV vaccine is administered usually at 16week of age. Although it was demonstrated by Underwood *et al.*, 2004, that there may still be active antibody response when vaccinated in the face of high MDA levels ($> \log 2^3$ HI unit), the kinetic pattern or amplitude is lower in chickens vaccinated than those not vaccinated or those with low MDA against NDV ($< \log 2^{2.5}$). This means that birds vaccinated when MDA is high or low will not be able to resist the virulent virus as much as the birds vaccinated when MDA had fallen below log 2³.

A significant difference ($p < 0.05$) was also recorded in the MDA titre of the chicks against NDV in the two different farms. Every farm has its own management systems which, although may be close to being the same, are slightly different from each other. These slight changes range from the viability of the vaccine used, the time of administration of vaccine and frequency of vaccination,

the serotypes of vaccine virus used, the dilution ratio of the vaccine (especially those used orally), and the health status of the parent birds to the general hygiene of different farms (Underwood *et al.*, 2004).

Another concern of vaccinating day-old chicks when MDA against NDV is high is that vaccine virus replication will be suppressed and active replication will be delayed until the MDA level against NDV has declined below the protective level. In intraocular vaccination too, replication of the vaccine virus will be delayed in the birds with high MDA until the level of MDA has reduced. This practice can pose great risk to the poultry industry in Nigeria as reported in Australia by Underwood *et al.* (2004) who reported the evolution of virulence of wild-type viruses in that country maybe due to vaccinating birds when MDA is high.

The MDA, at high level, may also cause the neutralization of vaccine virus as a result of the negative feedback to the brain, thereby mopping them up. This then leaves the birds unprotected against the wild-type virus except another vaccination is done because any strategy that separates the time of administration from the time of an active immune response opens the opportunity for wild-type virus entry/replication before vaccine virus replication. The importance of checking the serological status of flocks on the farms regularly can, therefore, not be overemphasized.

CONCLUSION

In conclusion, it was discovered that the average MDA titre levels in chicks still exist at a high level ($> \text{Log } 2^6$) sufficient to interfere with active immune response at first week of age. Therefore, farmers are to be

educated on the importance of checking their birds' serological status before vaccination.

REFERENCES

- Alexander, D. J.** 2001. Newcastle Disease. *British Poultry Science*, 42: 5-22.
- Allan, W. H., Gough, R. F. A.** 1974. A standard haemagglutination inhibition test for Newcastle disease: a macro and micro methods. *Veterinary Records*, 95: 120-123.
- Al-Zubeedy, A. Z.** 2009. Immune response in day old broiler chicks vaccinated against Newcastle disease virus. *Iraqi Journal of Veterinary Sciences*, 23 (2):143-146.
- Arshad, M., Ajmal, M., Rauf, A., Rizvi, A. R., Naeem, M.** 1988. Isolation of Newcastle disease virus from pigeons, starlings and sparrows from Faisalabad and Lahore district, Pakistan. *Pakistan Journal of Zoology*, 20: 367-371.
- Awang, I. P. R., Wan-Ahmed-Kusairy, W. S., Abdul-Razak, J.** 1992. Detection of maternal antibody against Newcastle disease virus in chicks using an indirect immunoperoxidase test. *Journal of Veterinary Medicine, Malaysia*, 4: 19-23.
- Chu, H. P., Rizk, J.** 1975. The effect of maternal immunity, age at vaccination and doses of live vaccines on immune response to Newcastle disease. *Developments in Biological Standards*, 28: 451-463.
- Coakes, S. J., Steed, L., Dzidic, P.** 2006. SPSS version 13.0 for Windows. Wiley Student Edition. Wiley India (P) Ltd., New Delhi-110002, India.
- Dipeolu, M. A., Keripe, O. M., Gbada-**

- mosi, A. J.** 1998. Chick Mortality in indigenous Chicken under Free Range System in Abeokuta, Nigeria. *Nigeria Veterinarians*, 1 (19): 5-11.
- Goddard, R. D., Wyeth, P. J., Varney, W. C.** 1994. Vaccination of commercial layer chicks against infectious bursal disease with maternally derived antibodies. *Veterinary Record*, 135: 273-274.
- Kumar, K., Singh, K. C. P., Prasad, C. B.** 2000. Immune responses to intermediate strain IBD vaccine at different levels of maternal antibody in broiler chickens. *Tropical Animal Health Production*, 32: 357-360.
- Jalil, M. A., Samad, M. A., Islam, M. T.** 2009. Evaluation of maternally derived antibodies against Newcastle Disease Virus And Its Effect On Vaccination In Broiler Chicks, *Bangladesh Journal of Veterinary Medicine*, 7(2): 296 – 302
- Manchang, T. K., Abdu, P. A., Saidu, L.** 2004. Epidemiology and Clinicopathologic Manifestations of Newcastle Disease in Nigerian Local Chickens. *Revue Elev. Med. Pays Trop.*, 57 (1-2): 35- 39.
- Saidu, L. P., Abdu, A., Markus, E. L.** 1998. Retrospective Studies on Newcastle Disease in Vaccinated Flocks in Zaria, Nigeria. *Student Veterinarians*, 17: 27-31.
- Saliu, O. J., Sanda, M. E., Audu, S. I.** 2009. Adoption of vaccination against Newcastle disease by rural poultry women farmers in the North Central Zone of Nigeria. *International Journal of Poultry Science*, 8(5): 500-503.
- Samad, M. A.** 2005. Poultry Science and Medicine, 1st ed., LEP publication. BAU campus, Mymensingh. pp. 170-192.
- Underwood, G., Jackson, C., Mackenzie, M., DeLaney, D.** 2004. Effect of maternal (passive) antibody on Newcastle disease virus (NDV) replication. Could deviation from the national standard operating procedures (SOPs) contribute to evolution in virus virulence? Proc. 5th Asian Pacific Poultry Health Conference. Ed. AVPA. Surfers Paradise, Queensland, p 9.
- Westbury, H. A.** 1984. Comparison of the immunogenicity of NDV strains V4, B1 and LaSota in chickens. 1. Tests in susceptible chickens. *Australian Veterinary Journal*, 61: 5-9.

(Manuscript received: 16th January, 2013; accepted: 1st September, 2014).