IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 7 Ver. II (July. 2015), PP 13-15
www.iosrjournals.org

Effects of Vitamins A, C and E and Selenium on Immune Response of Broilers to Newcastle Disease (ND) Vaccine

Sanda M.E.[1], Ezeibe M.C.O.[2]andAnene B.M.[2]
[1](Department of Animal Production, Faculty of Agriculture,Kogi State University, Anyigba, Nigeria)
[2](Department of Veterinary Medicine, University of Nigeria, (UNN), Nsukka, Nigeria)

Abstract:*One hundred day old broiler chicks used for this study were grouped into 5 experimental groups 1 to 5 with group 5 being the control group. Feeds of groups 1, 2, 3 and 4 were supplemented with Vitamin A, Vitamin C, Vitamin E + Selenium and a combination of Vitamins A + C + E and Selenium respectively. All the birds were vaccinated against ND with LaSota in drinking water at 21 days of age. Sera samples were obtained at weeks 2, 3, 4 and 5 post LaSota vaccination to measure antibody titres using HI test. All the groups fed vitamin – mineral supplemented feeds had higher HI titres than the control group 5 (P< 0.05). High level vitamin – mineral supplementation was beneficial to enhancing immune responses of broilers vaccinated against NDV.*

Keywords: *Newcastle disease, Vitamins, Minerals, Broilers, Immune response*

I. Introduction

In Africa and Asia, Newcastle disease (ND) is a major constraint to development of both commercial and village poultry production (Alders *et al*., 2001). Newcastle disease is a highly contagious viral disease affecting many species of domestic and wild birds (Al-Garib *et al*., 2003).

The causative agent of ND is Newcastle disease virus (NDV), also known as avian Paramyxovirus (APMV-1), a negative sense single-stranded RNA virus, belonging to the family Paramyxoviridae. Strains of NDV are classified into highly virulent (velogenic), mildly virulent (mesogenic) and the avirulent (lentogenic) based on their pathogenicity in chickens (Beard and Hanson, 1984).

Adene (1990) and Spradbrow (1997) reported that Newcastle disease is the most important viral disease of poultry in the world including developing countries. The disease causes high economic losses due to high mortality, morbidity, stress, decreased egg production and hatchability (Alexander, 2000; Darminto and Ronohardjo, 1996). Vaccination is the major control measure against endemic ND (Orajaka *et al*., 1999).

In Nigeria, the National Veterinary Research Institute (NVRI) recommends a vaccination schedule that includes administration of a live lentogenic B1 strain by intraocular instillation to chicks from day old, followed by another live lentogenic vaccine (LaSota) in drinking water as from the 3rd week of life and later by a live mesogenic vaccine (Komarov) by intramuscular injection (0.2 ml i/m) for breeders and layers at 6 weeks old, and subsequently at intervals of 6 months.

Despite these vaccines and the vaccination program, ND still occurs in Nigeria every year, causing high morbidity and mortality in poultry population and therefore creating a major constraint in development of the poultry industry in Nigeria.Vitamins and minerals are very important in poultry production, because, they are anti-stress agents. Stress and disease conditions in poultry may increase the basic requirements of the chicks for certain vitamins and minerals.

Vitamin needs of birds depend largely on their physiological make up, age, health and nutritional status and functions. Vitamin requirements determined several decades ago may not apply to today's poultry (Dudley – Cash, 1994; McDowell and Ward, 2009).

Johri (2009) advocated enhancement of immune response of poultry by nutritional manipulation because problem of immunosuppression in poultry could be associated with management conditions, nutritional status, intensive production system, high density rearing and infectious diseases. He further reported that administration of certain vitamins, minerals, amino acids and their different combinations to mammals and chicken in excess of their supposed requirements enhances disease resistance and this resistance is attributed to significant stimulation of humoral and cellular immunity and phagocytosis. Johri (2009) also recommended the use of supplementary immuno – stimulatory nutrients in poultry feeding.

Most of the poultry feeds available in Nigeria today have just enough vitamins and minerals to prevent deficiency diseases but not enough to stimulate immune responses. McDowell and Ward (2009) recommended optimal vitamin nutrition for optimal poultry performance in terms of weight gain, immune responses and disease resistance.

Cunha (1985) and Nockels *et al.* (1996) reported that nutrient levels that are adequate for growth, feed efficiency and gestation may not be adequate for normal immunity for maximizing the animal's resistance to disease. This suggests that for optimal immune response to ND vaccinations, poultry feeds should be supplemented with suitable vitamins and minerals like Vitamins A, C, and E and Selenium using optimum vitamin mineral allowances as recommended by McDowell, 2000 and McDowell & Ward, 2009).

Poultry under intensive production systems are particularly susceptible to vitamin deficiencies because of the following reasons; Poultry derive little or no benefits from microbial synthesis of vitamins in the gastrointestinal tracts, poultry have high requirements for vitamins and minerals and the high density concentration of modern poultry operation places great stress on the birds and increases their vitamin requirements (McDowell and Ward, 2009).

Attempt was therefore made in this study to boost the immunity of ND vaccinated birds by supplementing the feeds of broiler chicks with Vitamins A, C, and E and Selenium.

II. Materials And Methods

One hundred day old broiler chicks were obtained and divided into 5 experimental groups namely 1, 2, 3, 4 and 5. Broilers in the different groups were fed commercial feed and given water ad libitum. The feeds of group 1 was supplemented with Vitamin A (375mg), group 2 with Vitamin C (10g), group 3 with a combination of Vitamin E (7.5g) and Selenium (12.5mg) and group 4 with Vitamins A (375mg) + C (10g) + E (7.5g) and Selenium (12.5mg). Group 5 serving as the control group received no additional vitamin or mineral supplementation.

Birds of all the groups received both ND primary vaccination with Hitchner B1 strain intraocularly on Day 8 of life and the secondary vaccination with LaSota in drinking water on Day 21. Five birds from each group were bled at 2, 3, 4, and 5 weeks post LaSota vaccination.

Sera samples were collected from all the groups and were subjected to Haemagglutination Inhibition (HI) test as described by Orajaka *et al.* (1999).

The HI titres obtained were transformed to Log10 and subjected to ANOVA using the Statistical Package for Social Sciences (SPSS 15) software.

III. Results And Discussion

A Effect of Vitamins A, C, E and Selenium on immune response of broiler chicks to ND vaccination is as shown on Table 1.

Table 1: Effects of Vitamins A, C and E & Selenium on Immune Response of Broilers to ND Vaccination (LaSota)

Weeks post Vaccination(PV)	Group 1 (Vitamin A)	Group 2 (Vitamin C)	Group 3 (Vitamin E and Selenium	Group 4 (Vitamins A, C, and E & Selenium)	Group 5 (Control)
2	2.59±0.16	2.11±0.56	2.59±0.75	2.65±0.31	$2.23±0.16^{NS}$
3	$2.29±0.16^{abc}$	$2.11±0.21^{ab}$	$2.59±0.50^{c}$	$2.41±0.21^{bc}$	$1.93±0.16^{a}$
4	$1.99±0.16^{b}$	$1.93±0.26^{ab}$	$1.93±0.34^{b}$	$2.17±0.25^{b}$	$1.57±0.25^{a}$
5	$1.87±0.25^{ab}$	$1.93±0.34^{b}$	$1.87±0.34^{ab}$	$1.93±0.34^{b}$	$1.51±0.21^{a}$

Different superscripts along the rows indicate significant difference between means along the rows at $P < 0.05$
NS – No significant difference $P > 0.05$

From Table 1 above, there was no significant difference ($P>0.05$) in the immunity of broilers in the different groups in week 2PV. Week 3 revealed that broilers fortified with Vitamin E and Selenium had significantly higher ($P<0.05$) immunity than all the other groups. In week 4, Vitamin A fortified group (Group 1) was significantly higher in immunity than the control, however, in week 5, group 2 and 4 fortified with Vitamin C, and a combination of vitamins A, C and E + Selenium respectively had a significantly higher ($P<0.05$) immunity than the control.

All the groups with fortified feeds retained higher HI titres than the control 3 weeks post vaccination. So the mineral and vitamins could help reduce rapid loss of NDV immunity.

The results suggest that Vitamins A, C and E and Selenium alone or their combination in a feed have immunostimulatory effects. The finding agrees with the reports of McDonald *et al.* (1998), Rama-Rao *et al.* (2004) and McDowell and Ward (2009) that Vitamins A, C, and E and Selenium stimulate the immune system.

Lin *et al.* (2006) also reported that higher than recommended levels of Vitamin A in feeds of layer chicks under stress was beneficial to laying performance and immune function.

Sahin and Kucuck (2001) and Lohakare *et al.* (2005), as well observed significant improvements in live weight, digestibility of nutrients and immunity measurements of poultry raised under stress when fed feeds supplemented with 200ppm Vitamin C.

Rama-Rao *et al*. (2004) also reported that both humoral and Cell Mediated Immune (CMI) responses in immunized chickens increased significantly with supplemental Vitamin E alone and in combination with Selenium when given at levels higher than the National Research Council (NRC) recommendations.

IV. Conclusion and Recommendation

In conclusion, fortifying feeds of broilers by additional inclusion of Vitamins A, C, E & Selenium boosted their immune response to NDV (LaSota) vaccination and retained the immunity for a longer period ($P < 0.05$) than the control.

It is recommended that commercial poultry feed producers supplement feeds with higher than the 1994 NRC recommended levels of Vitamins A, C, E and Selenium to ensure better immune responses of birds to vaccination. This may reduce cases of vaccination failure in the country. Policy makers in Nigeria may have to enforce this as the standard of feeds manufactured in the country.

References

[1.] Alders RG, Costa R, Dias P, Fringe R, Fumo A, Lobo Q, Mata BV, Silva A and Young MP (2001). Investigations into the control of Newcastle Disease in Village Chickens in Mozambique: Review of work done in Mozambique. Report on the ACIAR/INIVE Newcastle Disease Control Project Coordination Meeting, Tofo, Inhambane Province, Appendix 3.

[2.] Al-Garib SO, Gielkens AlJ, and Coch G (2003). Review of Newcastle Disease Virus with particular references to immunity and vaccination. World Poultry Science Journal 59: 185-197

[3.] Beard CW and Hanson RP (1984). Newcastle Disease. In: Hofstad M. S., H.J. Barnes, B.W. Calnek, W.M. Reid, and H.W. Yoder (Eds.), Diseases of Poultry (pp. 450 - 470), Iowa State University Press, Ames.

[4.] Adene DF (1990). Country Report on the Management and Health Problems of Rural Poultry Stock in Nigeria. In: Proceedings of Seminar on Small Holder Rural Poultry Production. Intl. Centre for Trop. Agric. (CTA). Thessaloniki, Greece. 9-13th October, pp 175-182.

[5.] Spradbrow PB (1997). Policy framework for smallholder rural poultry development. In: Proceedings of International Workshop on Sustainable Poultry Production in Arica held in Addis Ababa, Ethopia (pp. 30 – 39).

[6.] Alexander DJ (2000). Newcastle Disease and other Avian paramyxoviruses. In: Revue Scientifique et Technique de l' OIE pp. 443-462.

[7.] Orajaka LJE, Adene DF, Anene BM, and Onuoha EA (1999). Seroprevalence of Newcastle disease in local chickens from Southeast derived Savannah zone of Nigeria. Revue Élev. Méd. Vét Pays trop. 52: (3-4): 185 – 188.

[8.] Dudley-Cash WA (1994). Supplemental vitamin use in poultry feeds varies considerably. Feedstuffs. 66(6):12.

[9.] McDowell LR and Ward NE (2009). Optimum Vitamin Nutrition for Poultry. [Accessed 12/11/2010]. Available online: http://www.dsm.com/le/static/ovnrovimix/downloads/OVN_increased_meat_quality_and_productivity.pdf

[10.] JohriTS (2009). Poultry Nutrition Research In India and Its Perspective Central Avian Research Institute [Online] Accessed on 12/09/2010. Available online at: http://www.fao.org/docrep/article/agrippa/659_en00.htm pp 1-28.

[11.] Cunha TJ (1985). Nutrition and disease interaction. Feedstuffs57(41):37-42

[12.] Nockels CF, Odde KG and Craig AM (1996). Vitamin E supplementation and stress affect tissue –tocopherol content of beef heifers. Journal of Animal Science 74:672.

[13.] McDowell, LR (2000). Vitamins in animal and human nutrition. Iowa State University Press, Ames, IA. pp. 793.

[14.] SPSS – Statistical Program for Social Sciences. IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

[15.] McDonald P, Edwards RA, Greenhalgh JFD and Morgan CA (1998). Vitamins and Minerals. In: Animal Nutrition. 5th Edition. Longman. 5: 66-127

[16.] Rama-Rao SV, Raju MVLN and Nagalakshmi, D (2004). Nutritional modulation to enhance immunity in chickens. Poultry International April 2004 Watt Publishing Co. pp 24-29.

[17.] Lin H, Jiao HC, Buyse J and Decuypere E (2006). Strategies for preventing heat stress in poultry. World Poultry Science Journal, 62:71-86.

[18.] Sahin K and Kucuk O (2001). Effects of Vitamin C and Vitamin E on performance, digestion of nutrients and carcass characteristics of Japanese quails reared under chronic heat stress (340C). Journal of Animal Physiology and Animal Nutrition. 85:335-342.

[19.] Lohakare JD, Kim JK, Ryu MH, Hahn TW and Chae BJ (2005). Effect of vitamin C and vitamin D interaction on the performance, immunity and bone characteristics of commercial broilers. Journal of Applied Poultry Research 14: 670-678.

[20.] Darminto D and Ronohardjo P (1996). Inactive vaccine derived from velogenic local strain of Newcastle disease virus. Indonesian Journal of Animal and Veterinary Sciences 2(1):42-49.

[21.] NRC - National Research Council, (1994). Nutrient Requirements of Chickens, Nutrient Requirements of Poultry. 9th Ed., National Academy Press, Washington, DC. pp: 19-34.