



## Haematological and Gross Pathological Changes in Broilers Experimentally Challenged with Velogenic Strain of Newcastle Disease Virus

C. O. Faeji<sup>1\*</sup>, M. K. Oladunmoye<sup>2</sup>, I. A. Adebayo<sup>3</sup> and T. T. Adebolu<sup>2</sup>

<sup>1</sup>Department of Medical Microbiology and Parasitology, CMHS, Afe Babalola University, Ado Ekiti, Ekiti State, Nigeria.

<sup>2</sup>Department of Microbiology, Federal University of Technology, Akure, Ondo State, Nigeria.

<sup>3</sup>Department of Animal Production and Health, Federal University of Technology, Akure, Ondo State, Nigeria.

### Authors' contributions

This work was carried out in collaboration among all authors. Authors IAA and MKO designed the study. Author COF performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors IAA and TTA managed the analyses of the study. Author COF managed the literature searches. All authors read and approved the final manuscript.

### Article Information

#### Editor(s):

(1) Dr. Juan Carlos Troiano, Professor, Department of Medicine and Production of Fauna, School of Veterinary Medicine, University of Buenos Aires, Buenos Aires, Argentina.

#### Reviewers:

(1) Ronald Iorio, University of Massachusetts Medical School, USA.  
(2) Vanessa de Oliveira Ribeiro, Instituto Triade para Medicina da Conservação, Brazil.  
Complete Peer review History: <http://www.sdiarticle3.com/review-history/49324>

Original Research Article

Received 17 March 2019

Accepted 30 May 2019

Published 27 June 2019

### ABSTRACT

Newcastle disease (ND) is a severe and fatal disease of poultry caused by Newcastle Disease Virus (NDV). The disease is of economic and public health importance and has been a threat to the growth of poultry industry. A hundred and twenty day-old broiler chickens were procured from a commercial breeder farm. Glucose, vitamin, antibiotics were administered accordingly. Birds were tested for antibodies to NDV and vaccines were administered accordingly. Feed and water were also provided *ad-libitum*. Birds were randomly distributed into groups. Experimental birds were challenged at five weeks of age. Blood samples were collected for haematology assay periodically after challenging with NDV. The erythrocyte response in the chickens had varying patterns; there were significant reduction in values of Total Erythrocyte Count, Packed Cell Volume, Hemoglobin

\*Corresponding author: E-mail: faejicharles@gmail.com;

count in infected chickens. Monocytes were reduced significantly in the infected birds to  $7\pm 0.6\%$  as compared to uninfected birds which had  $10\pm 0.9\%$ . There were no significant changes in the Eosinophil and basophil absolute values in both infected and uninfected birds during the course of the study. This study showed that haematological values of broiler chicken significantly differ ( $p < 0.05$ ) from uninfected and infected birds with virulent NDV. Generally, there were no significant differences in the profile of the vaccinated birds. Hence the need for vaccination and research towards anti-NDV therapeutic discoveries cannot be overemphasized.

**Keywords:** *Haematology; velogenic; Newcastle disease virus; broiler.*

## 1. INTRODUCTION

Newcastle disease (ND) is a severe and fatal disease of poultry caused by Newcastle disease virus (NDV) which belongs to the family paramyxovirus (PMV). The disease is of economic and public health importance and has been a threat to the growth of poultry industry. Chickens of all ages are susceptible to NDV but the severity observed in unvaccinated birds is more when compared to vaccinated birds [1]. NDV can also cause conjunctivitis in humans, usually when the person has been constantly exposed to infected birds. Mostly, Laboratory workers, vaccinators, poultry attendants and vaccination crews are often at risk [2]. Humans, though mildly, are among the many species that can be infected by NDV in addition to avian species. In some cases, mild, self-limiting influenza-like disease with fever and headache has also been reported in humans [3,4] The use of personnel protective equipment and biological safety cabinet can reduce the spread of the infection while scheduled vaccination can be employed in animal to prevent outbreak or spread of the virus. Assay of different indices of the blood can provide insight about the health status of both human and animals [5]. Esonu et al. [6] reported that the haematological parameters can reveal the physiological conditions of an animal to certain environmental factors and microbial agents. Therefore this study was conducted in order to evaluate the haematology indices of broiler chickens infected with virulent NDV.

## 2. METHODS

Hundred and twenty day-old broiler chickens were procured from a commercial breeder farm. The chickens were brooded and raised in a pen constructed in an isolated location on the Veterinary Experimental Unit of the Teaching and Research Farm of Federal University Technology Akure (FUTA). Antibiotics, vitamin and glucose

were administered accordingly. Feed and water were provided *ad-libitum*. Birds were randomly distributed into groups and tested for antibodies to NDV. Virus stock of Kudu strain was obtained from National Veterinary Research Institute, Vom and was transported under cold chain to the research facility at FUTA where challenge was carried out. The Virus contained  $1 \times 10^8$  EID<sub>50</sub> /ml and was reconstituted according to the manufacturer's instructions. Experimental birds were challenged at five weeks of age. Blood samples were collected before challenge and 5-7 days post challenge with the virus from the birds at regular interval. Haematological parameters including total red blood cells count (RBC), differential count of leucocytes which are neutrophil, lymphocyte, monocyte, hemoglobin, and packed cell volume (PCV) were enumerated as adapted from the method of Eze et al. [7].

## 2.1 Statistical Analysis

The data obtained were analysed using SPSS version 21 and values were presented in mean  $\pm$ SD. Analysis of variance test was used for haematological differences and means were compared by LSD at  $p < 0.05$  level of significance.

## 3. RESULTS

**Table 1. Haematological parameters of NDV challenged vaccinated broilers**

Parameters	NDV Infected	Uninfected
ESR (mm)	$3\pm 0.8$	$3\pm 0.9$
PCV (%)	$25\pm 0.14$	$30\pm 0.18$
RBC ( $\times 10^6/\mu\text{l}$ )	$2.44\pm 0.6$	$2.55\pm 0.08$
Hb (g/dl)	$9.7\pm 0.17$	$10.3\pm 0.18$
LYM (%)	$67\pm 0.2$	$66\pm 0.23$
HET (%)	$26\pm 1.6$	$27\pm 0.9$
MON (%)	$11\pm 0.01$	$12\pm 0.04$
BAS (%)	$2\pm 0.01$	$2\pm 0.01$
EOS (%)	$1\pm 0.16$	$1\pm 0.2$

*p < 0.05 (significant at 0.05), Mean  $\pm$  SD of 10 values per group*

**Table 2. Haematological parameters of NDV challenged unvaccinated broilers**

Parameters	NDV Infected	Uninfected
ESR (mm)	4±0.03	3±0.06
PCV (%)	28±0.4	31±0.42
RBC (x10 <sup>6</sup> /μl)	2.06±0.1	2.69±0.1
Hb (g/dl)	9.3±0.23	10.1±0.19
LYM (%)	72±0.1	67±0.02
HET (%)	22±0.08	28±0.09
MON (%)	7±0.6	10±0.9
BAS (%)	2±0.01	3±0.01
EOS (%)	1±0.0	1±0.0

*p*<0.05 (significant at 0.05), Mean ± SD of 10 values per group



**Plate 1. Petechiae haemorrhage seen in proventriculus of experimental bird**

#### 4. DISCUSSION AND CONCLUSION

The erythrocyte response in the chickens had varying patterns in this study, though there was significant depression of Red Blood Cell (RBC), Packed Cell Volume (PCV) and Hemoglobin Count (Hb) in infected chickens when compared with the uninfected indicating possible anemia [7]. Haemoglobin concentration (Hb) of normal broiler birds was noticed as 10.1±0.19 (g/dl) while that of ND affected birds was 9.3±0.23 (g/dl) (Table 2). This decrease in Hb concentration in ND affected birds was significant (*p*-value<0.05). Results obtained in this study support the findings of Adeyemo and Sani [8].

Lymphocytes values were found significantly higher in the infected birds than the uninfected chickens Heterophils decreased significantly in infected broilers. This is in agreement to studies

of Calderon et al. [9] and Eze et al. [7] who reported similar findings.

The monocytes were reduced significantly in the infected birds to 7±0.6% as compared to uninfected birds which had 10±0.9%. This condition is referred to as Monocytopenia which is a decrease in monocyte count. This might be due to acute infection of ND in broilers [10].

The monocytes in the blood are in transit between the marrow and tissues, where they are transformed into tissue macrophages [11]. They participate virtually in all inflammatory and immune disorders such as severe viral and bacterial infections for mopping up of necrotic debris [12].

The leukocytic variations observed in this study indicate that NDV exert significant depression on

leucogram (Table 2). Differential leucocytes counts could serve as indicators of stress response which are germane to immune functions [13]. It has however been reported that quite a number of bacterial and viral diseases affect the number of white corpuscles of in healthy animals, The number could vary slightly from animal to animal but greatly differs in unhealthy animals [14].

There were no significant changes in the eosinophil and basophil absolute values in both infected and uninfected birds during the course of the study. This is also in agreement with report of [9]. This observation may be due to functions of eosinophils and basophils which are important in parasitic infections and hypersensitivity reactions accordingly [15].

Generally, there were no significant differences in the profile of the vaccinated birds, this is probably due to the immunological response already initiated by the vaccine virus [16]. There were slight variations in the values, however within physiological range (Table 1).

Symptoms and lesions are significant in establishing the disease and are also reliable in diagnosis of ND infection. Postmortem examination revealed Petechiae hemorrhage on the proventriculus and cecal tonsil (Plate 1), as well as congestion of trachea and lung. These observations are in accordance with the reports of xiao et al. [17] Clinical symptoms also observed includes depression, inappetence, anorexia, greenish-white diarrhea, torticollis, morbidity and mortality, Based on observation of clinical symptoms, it is positive that the ND infection was of a velogenic strain [18,19]. However there were no observable or related signs to the infected birds in uninfected birds.

This study showed that haematological values of broiler chicken differs when challenged with virulent NDV. The RBC, Hb and monocyte reduced while lymphocytes increase significantly in infected broiler birds. Therefore NDV affects the haemogram and leucogram in broilers. This furthermore buttresses the severity of ND caused by velogenic strain, hence the need for vaccination and research towards anti-NDV therapeutic discoveries cannot be overemphasized.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

Experiment was carried out in accordance with the ethical guidelines of the University.

## ACKNOWLEDGEMENT

The authors wish to thank everyone who assisted at different stages of the research including Prof Oso I.B, Dr. Shittu Ismaila. The authors declare that they have no conflict of interest.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Akele YR, Tattfeng YM, Ojiezeh IT, Chollom CS, Enitan SS, Olayanju OA. Evaluation of the efficacy of Newcastle disease (Lasota) live vaccines sold in Jos, Plateau State, Nigeria. *European Science Journal*. 2014;10(27):1857-7431.
2. Zhang Y, Zhang S, Wang X, Zhang G. Complete genome sequence of a sub-genotype vii d Newcastle disease virus circulating predominantly in chickens in Ch. *Jour. of Vir.* 2012;86(24):13849-13850.
3. Alexander D. Newcastle disease and other avian paramyxoviruses. *Rev. Sci. Tech.* 2000;19(4):443-462.
4. Office International Des Epizooties (OIE). *Manual of diagnostic tests and vaccines for terrestrial animals: Mammals, birds and bees.* Biological Standards Commission. W. Org. for Anim. H., Paris. 2012;1-19.
5. Talebi S, Asri R, Rozeh C, Sahraei G. Comparative studies on haematological values of broiler strains (Ross, Cobb, Arbor-acres and Arian). *Int. J. Poult. Sci.* 2005;4(8):573-579.
6. Esonu B, Iheukwumere F, Emenalom O, Uchegbu M, Etuk E. Performance, nutrient utilization and organ characteristics of broilers fed *Microdesmis puberula* leaf meal. *Jour. of Liv. Prod. Rural Dev.* 2002;14(2):6-12.
7. Eze C, Okoye J, Ogbonna I, Ezema W, Eze D, Okwori E, Okorie-Kanu C, Idika I. Comparative evaluation of the effects of velogenic Newcastle disease virus infection on the hematology of ducks and

- chickens. Op. Jour. of Vet. Med. 2014;4(2):113-121.
8. Adeyemo I, Sani A. Haematological parameters and serum biochemical indices of broiler chickens fed *Aspergillus niger* hydrolyzed cassava peel meal based diet. IJRRAS. 2013;15(3):124-130.
  9. Calderon N, Galindo F, Ortiz M, Lomniezi B, Fehervari T, Paaseh L. Thrombocytopenia in Newcastle disease: Haematological evaluation and histological study of bone marrow. Act. Vet. Hung. 2005;53(9):507-513.
  10. Chekwube P, Osita A, Innocent O, Wilfred S, Didacus C, Emmanuel H, Christan K, Kalu I. Comparative evaluation of the effects of velogenic Newcastle disease virus infection on the hematology of ducks and chicken. Open J. Vet. Med. 2014;4(6):113-121.
  11. Grogan K, Fernandez R, Barranon F, Espinosa H. Avian immune system: A brief review. Gaines. Jour. of Med. Sci. 2008;2(1):1-12.
  12. Ojjezeh T, Ophori E. Haemogram and serum enzymes activities of Newcastle disease virus challenged broiler chickens following supplemental treatment with *Aloe vera* extract. J. Clin. Cell Immunol. 2015;6(2):282-296.
  13. Graczyk S, Pliszczak-Krol A, Kotonski B, Willzek J, Chmielak Z. Examination of haematological and metabolic changes mechanisms of acute stress in Turkeys. Elect. Jour. of Pol. Agri. and Univ. Vet. Med. 2003;6(2):1-10.
  14. Uchegbu M, Ezuma C, Ogbuewu I, Opara M. Physiological responses of finisher broilers to yam Peel meal: Haematology and serum biochemistry. Elect. Jour. of Env. Agr. and F. Chem. 2010;9(3):1657-1664.
  15. Malik M, Sohail N, Sajid H, Hamidullah S, Bano N, Shah S. Effects of Newcastle disease virus on different haematological parameters in broilers. Adv. Anim. Vet. Sci. 2018;6(4):183-186.
  16. Spinu M, Spinu O, Degen AA. Haematological and immunological variables in a domesticated and wild subspecies of ostrich (*Struthio camelus*). Br Poult Sci. 1999;40:613-8.
  17. Balachandran P, Srinivasan P, Sivaseelan S, Balasubramaniam GA, Gopala Krishna Murthy TR. Isolation and characterization of Newcastle disease virus from vaccinated commercial layer chicken. Vet. World. 2014;7(7):457-462.
  18. Panus A, Setiyaningsih S, Mayasari NLP. Newcastle disease virus infection study on duck and chicken in Subang District. J. Ilmu Ternak Vet. 2015;20(2):134-147.
  19. Xiao S, Paldurai A, Nayak B, Samuel A, Bharoto AE, Prajitno TY, Collins PL, Samal SK. Complete genome sequences of Newcastle disease virus strains circulating in chicken populations of Indonesia. J. Virol. 2012;86(10):5969-5970.

© 2019 Faeji et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:  
The peer review history for this paper can be accessed here:  
<http://www.sdiarticle3.com/review-history/49324>