

GENETIC VARIATION AND THE IMMUNE RESPONSE TRAITS OF THREE IMPROVED NIGERIAN LOCAL CHICKEN STRAINS.

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ABSTRACT

The immune response traits of three improved Nigerian indigenous strains of chicken (Frizzle feathered – FF, Normal feathered – NF and Naked neck – NN) were studied with a view to assessing their physiological status and as such response to infections. Sixty (60) birds comprising twenty (20) from each of the strains were used. The birds were raised on deep liter with commercial growers' mash and water provided ad libitum. Blood samples were collected from each of the strains and analyzed for Haematological parameters - Packed Cell Volume (PCV), Haemoglobin (Hb), Red Blood Cell (RBC), White Blood Cell (WBC), Heterophils (Hetero), Lymphocytes (Lym) - Eosinophils (Eos), Monocytes (Mono) and Basophils (Bas) - the immune response traits. Data collected were analyzed using the SPSS ver. 20, significantly different means were separated using the Duncan Multiple Range Test (DMRT). Results showed that Eos in week 4, Mono in week 8, Bas in weeks 4, 8, 12 and WBC, Hetero, Lym in week 12 all differed ($p < 0.05$) significantly from each other. The birds showed an improved physiological state thus improving the immune system, an indication of their ability to withstand infection.

Keywords: Genetic variation, Immune response traits, Local chicken, Strains

INTRODUCTION

Poultry production in Nigeria is estimated at 140 million and the indigenous or local chicken is known to account for about 90% of the total poultry production in Nigeria, representing valuable resources for livestock development and improvement because of their extensive genetic diversity (FAO, 2020).

Local chicken seems to be resistant to adverse conditions when compared with their exotic counterpart as a result of some unique adaptive features developed over a long period of random mating in their natural ecosystem. They are still the option for supplying the human population with protein and income. Due to their short generation interval and products, they are preferred by majority of Nigerians, having the potentials of providing proteins and meats that can meet the demand of the citizen globally (Nosike *et al.*, 2020). Although there exist phenotypic variations amongst Nigerian local chickens such as the frizzle and normal feathered structure, the naked neck and modifier effects which allows for rearing under different conditions as well as providing a range of products and functions, they are known to be self – reliant and hardy birds with the capacity to withstand harsh weather conditions and adapt favourably (Ikpeme *et al.*, 2016).

However, the problem of the local chicken is poor production performance (egg and meat), compared to their exotic counterpart which have been selected genetically over time. Thus, there is the need for the local strains to be improved, increasing their productivity as well as reduce the rate at which they are being replaced by commercial strains. Controlling diseases accounts for increased production cost, besides posing hazards to human health. Genetic resistance to disease is a powerful tool to control and prevent diseases with the attendant improvement in production and dividend in the livestock and poultry industry (Liza *et al.*, 2022).

The study was carried out to assess the immune response traits of the local chicken strains with a view to having an understanding of their ability to withstand infections.

MATERIALS AND METHODS

Study location

The study was carried out at the Poultry Unit, Teaching and Research Farm of the Department of Animal Science, University of Uyo, Akwa Ibom State.

Experimental birds and management

A total of one hundred and fifty day – old chicks of Nigerian indigenous origin which comprises of fifty (50) normal feathered, fifty (50) frizzle feathered and fifty (50) naked neck, which were purchased from

the Federal University of Agriculture, Abeokuta, Ogun State, was used in the study. Routine management was administered, while feed and water were given *ad libitum* to the birds.

Experimental design

The Completely randomized Design was used in the study.

Data collection

Sixty birds, twenty each from the different strains (20 normal feathered, 20 frizzles feathered and 20 naked neck) were selected for blood collection. Blood was collected at weeks 4, 8 and 12 with a 2ml syringe and needle and stored in Ethylenediaminetetraacetic acid (EDTA) bottles for Haematological analysis at the Biochemistry laboratory of the University of Uyo for analysis in lieu of the following immune response traits - Packed Cell Volume (PCV), Haemoglobin (Hb), Red Blood Cell (RBC), White Blood Cell (WBC), Heterophils (Hetero), Lymphocytes (Lym), Eosinophils (Eos), Monocytes (Mono) and Basophils (Bas).

Data analysis

The data collected were analyzed using the statistical package for social scientist (SPSS) version 20.0, significantly different means were separated using the Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The effects of genotype on the immune response traits (PCV, Hb, RBC, WBC, Heter, Lym, Eos, Bas and Mono) in improved Nigerian local chickens were studied. The results in Table 1 for week 4 showed that Frizzle feather chicken recorded significantly ($P < 0.05$) high value of (1.41 ± 0.24) in Eosinophil compared to Normal feathered chicken with (0.97 ± 0.21) and Naked neck (0.66 ± 0.24) at week 4 of age measured. However, Normal feathered chicken (0.96 ± 0.21) and Naked neck chicken (0.66 ± 0.24) were statistically ($P > 0.05$) similar in their mean values. For Basophil, Frizzle feathered chicken had higher ($P < 0.05$) significant means of (1.26 ± 0.27) than Normal feather chickens with (0.78 ± 0.24) and Naked neck (0.31 ± 0.27) at week 4 of age, while Normal feather chicken (0.78 ± 0.24) was significantly ($p < 0.05$) higher than (0.31 ± 0.27) of naked neck chickens for the same trait at week 4. However, there was no significant ($P > 0.05$) difference existing in Pcv, Hb, Rbc, Heter, Lym and Mono. This result is in line with the work of Akinbinu *et al.* (2022) who worked on the determination of immune response traits in Nigerian indigenous chickens challenged with Newcastle Inactive Antigen.

Table 1: Immune response traits of three improved Nigerian indigenous chicken at week 4.

Immune Traits	GENOTYPE		
	FF	NN	NF
PCV (ml)	29.38 ± 1.49	31.40 ± 1.50	28.79 ± 1.31
Hb (ml)	9.89 ± 0.50	10.33 ± 0.50	9.69 ± 0.44
RBC (m/mm ³)	2.53 ± 0.13	2.52 ± 0.13	2.53 ± 0.11
WBC (g/dl)	13.50 ± 0.73	12.65 ± 0.73	13.10 ± 0.64
Heter (um)	32.73 ± 2.10	29.94 ± 2.11	32.88 ± 1.84
Lym (k/uL)	63.85 ± 2.07	67.72 ± 2.08	64.62 ± 1.81
Eos (cell/McL)	1.41 ± 0.24^a	0.66 ± 0.24^{bc}	0.97 ± 0.21^c
Bas (um)	1.26 ± 0.27^a	0.31 ± 0.27^c	0.78 ± 0.24^b
Mono (ml)	0.92 ± 0.34	1.24 ± 0.34	0.91 ± 0.29

PCV=Packed Cell Volume, Hb= Haemoglobin, RBC= Red Blood Cell, WBC= White Blood Cell, Heter= Heterophils, Lym= Lymphocytes, Eos= Eosinophils, Bas= Basophils, Mono= Monocytes, FF= Frizzle Feathered, NN= Naked Neck, NF= Normal Feathered.

The result for week 8 is presented in Table 2. There were no significant ($p > 0.05$) differences among the means for PCV, Hb, RBC, WBC, Hetero, Lym and Eos of the birds. However, Mon was significantly ($p < 0.05$) different with the normal feathered (1.06 ± 0.25) and the naked neck (1.05 ± 0.28) which were not significantly ($p > 0.05$) different from each other, being different significantly ($p < 0.05$) from the frizzle feathered (0.83 ± 0.28). similarly, Bas showed the naked neck (0.41 ± 0.23), the frizzle feathered (0.38 ± 0.23) and the normal feathered (0.29 ± 0.20) all being significantly ($p < 0.05$) different from each other.

This result is in tandem with Akinbinu *et al.* (2022) in which significant values were recorded for Frizzle feathered, naked-neck and normal feathered, respectively. The result in Table 3 for week 12 showed that

Frizzle feather chicken recorded significantly ($p < 0.05$) high value of (15.96 ± 1.25) in White blood cell than naked neck chicken with (15.63 ± 1.25) and Normal feather (13.83 ± 1.09). Naked neck was significantly ($p < 0.05$) higher (31.494 ± 1.78) in Heterophil than frizzle feathered (26.92 ± 1.78) and Normal feather (26.79 ± 1.55) which did not differ significantly ($p < 0.05$) from each other. Frizzle (70.22 ± 1.60) and Normal feather (69.48 ± 1.40) were not different ($p > 0.05$) statistically in their mean values for Lymphocytes but were significantly ($p < 0.05$) higher than naked neck (65.41 ± 1.61). However, Normal feather (1.15 ± 0.25) was significantly ($P < 0.05$) higher than naked neck (0.71 ± 0.29) and Frizzle feather (0.64 ± 0.29) which showed no significant ($p > 0.05$) difference. This is not in line with the findings of Addass *et al.* (2017); Nosike *et al.* (2017); Opoola *et al.*, (2020); Akinbinu *et al.*, (2022) in some immune traits.

Table 2: Immune response traits of three improved Nigerian indigenous chicken at week 8.

Immune Traits	GENOTYPE		
	FF	NN	NF
PCV (ml)	31.44 ± 1.21	29.02 ± 1.21	30.34 ± 1.21
Hb (ml)	10.40 ± 0.41	9.70 ± 0.41	10.05 ± 0.36
RBC (m/mm ³)	2.60 ± 0.11	2.47 ± 0.12	2.46 ± 0.10
WBC (g/dl)	12.44 ± 1.42	11.91 ± 1.14	12.97 ± 0.99
Heter (um)	28.04 ± 2.09	28.16 ± 2.09	25.89 ± 1.82
Lym (k/uL)	70.24 ± 1.97	69.84 ± 1.97	69.22 ± 1.72
Eos (cell/McL)	0.52 ± 0.15	0.54 ± 0.15	0.53 ± 0.13
Bas (um)	0.38 ± 0.23^b	0.41 ± 0.23^a	0.29 ± 0.20^c
Mono (ml)	0.83 ± 0.28^c	1.05 ± 0.28^b	1.06 ± 0.25^a

PCV = Packed Cell Volume, Hb = Haemoglobin, RBC = Red Blood Cell, WBC = White Blood Cell, Heter = Heterophils, Lym = Lymphocytes, Eos = Eosinophils, Bas = Basophils, Mono = Monocytes, FF = Frizzle Feathered, NN = Naked Neck, NF = Normal Feathered.

Table 3: Immune response traits of three improved Nigerian indigenous chicken at week 12.

Immune Traits	GENOTYPE		
	FF	NN	NF
PCV (ml)	34.66 ± 1.52	35.04 ± 1.52	34.05 ± 1.33
Hb (ml)	11.49 ± 0.51	11.75 ± 0.51	11.33 ± 0.45
RBC (m/mm ³)	2.88 ± 0.15	2.97 ± 0.15	2.86 ± 0.13
WBC (g/dl)	15.96 ± 1.25^a	15.63 ± 1.25^a	13.83 ± 1.09^b
Heter (um)	26.92 ± 1.78^b	31.49 ± 1.78^a	26.79 ± 1.55^b
Lym (k/uL)	70.22 ± 1.60^a	65.41 ± 1.61^b	69.48 ± 1.40^a
Eos (cell/McL)	1.47 ± 0.28	1.42 ± 0.28	1.50 ± 0.25
Bas (um)	0.64 ± 0.29^b	0.71 ± 0.29^b	1.15 ± 0.25^a
Mono (ml)	0.75 ± 0.34	0.96 ± 0.35	1.12 ± 0.30

PCV = Packed Cell Volume, Hb = Haemoglobin, RBC = Red Blood Cell, WBC = White Blood Cell, Heter = Heterophils, Lym = Lymphocytes, Eos = Eosinophils, Bas = Basophils, Mono = Monocytes, FF = Frizzle Feathered, NN = Naked Neck, NF = Normal Feathered.

Packed Cell Volume (PCV) which is the percentage (%) of red blood cells in a blood sample shows a better transportation and thus results in an increase in primary and secondary polythelia as well as helps detect anemia (Adedibu *et al.*, 2018), Haemoglobin (Hb) the protein in the red blood cell that delivers oxygen to tissues and organs in the body and Red Blood Cell (RBC) that carries oxygen from the lungs to all parts of the body showed no significant ($p > 0.05$) differences across strains and age in this study. White Blood Cell (WBC) involved in fighting infections along with its components - Heterophils (Hetero) which have phagocytic ability and Lymphocytes (Lym) a natural killer able to kill diseased and distressed cells (Falcone *et al.*, 2020), showed no significant differences among FF and NN strains in weeks 4 and 8. Eosinophils (Eos) in week 4, Monocytes (Mono) in week 8 and Basophils (Bas) in weeks 4, 8, 12 all showed significant ($p < 0.05$) differences across strains, an indication of the fact that there is absence of stress, steroid and allergic reactions.

Whereas WBC, Hetero, Lym and Bas differed ($p < 0.05$) significantly among strains in week 12. It seems probable, in line with Onyishi *et al.*, 2017, that with increase in the age of the birds, the immune system

was improved to enable them withstand infections. These traits in their various proportions indicates different physiological states of the birds, studying them in different genetic strains will give an idea of how genetic modifications can be made to improve the performance of local chickens, develop and conserve its genetic worth.

CONCLUSION

From the result which elucidated that Eos in week 4, Mono in week 8, Bas in weeks 4, 8, 12 and WBC, Hetero, Lym in week 12 all differed ($p < 0.05$) significantly from each other. In conclusion the birds showed an improved physiological state thus improving the immune system which is an indication of their ability to withstand infection.

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