

Variation in Body Weights and Immune Response of FUNAAB Alpha and Exotic Broiler Chickens Inoculated with Attenuated *Eimeria tenella* Vaccine

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ABSTRACT

Background and Objective: Coccidiosis is one of the pathogenic diseases of economic importance to broiler chickens in the tropics. The aim of this study was to investigate the variation in body weight and immune response of FUNAAB Alpha and exotic broiler chickens inoculated with attenuated *Eimeria tenella* vaccine. **Materials and Methods:** The experiment was laid out in a completely randomized design for a period of 8 weeks. The experimental birds consist of 200 broilers of 2 breeds namely: Three strains of FUNAAB Alpha (normal feather, frizzle feather and naked neck) and one breed of exotic chicken (Arbor Acre). The body weight, haematological parameters and lesion counts were collected and analyzed for the effects of genotype pre and post-inoculation. **Results:** The Arbor Acre broiler chickens had significantly ($p < 0.05$) heaviest body weight at days 0, 6 and 15. There is variation in haematological responses to *E. tenella* challenged among the four broiler genotypes with the highest ($p < 0.05$) values of haematological parameters recorded in FUNAAB Alpha broilers. The oocyte counts, caecal and mucosa lesions were higher ($p < 0.05$) in Arbor Acre broilers. **Conclusion:** Therefore, the FUNAAB Alpha broilers can be selected against coccidiosis diseases for the development of broiler chickens or meat free from protozoan contamination in Nigeria.

KEYWORDS

Coccidiosis, Arbor Acre broiler, FUNAAB Alpha, haematology, oocyte counts, lesion score, *Eimeria tenella* vaccine

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INTRODUCTION

Coccidiosis has been identified as one of the most economically significant diseases of domestic chicken due to the tremendous morbidity and mortality it causes and also the enormous costs associated with its control^{1,2}. The genus *Eimeria* which are members of the intracellular parasite are responsible for this intestinal parasitic infection². There are seven different *Eimeria* species that can cause coccidiosis in chickens, some of which are more virulent than others. These include *E. tenella*, *E. maxima*, *E. necatrix* and *E. brunette*, others such as *E. acervulina*, *E. mitis* and *E. praecox* are less virulent².



The intestinal tracts of various animals and birds are the target of *Eimeria* parasites and infection from these parasites usually occurs when an animal consumes feed and water that have been contaminated with sporulated oocysts from *Eimeria* organism³. The typical symptoms of coccidiosis, which also has high mortality and morbidity rates, include dysentery, enteritis, diarrhea (which in some cases may be bloody due to the pathogenic *Eimeria* species), emaciation, a lower feed conversion rate, delayed sexual maturity, drooping wings, poor growth and low production. *E. tenella* is the most frequent and pathogenic among *Eimeria* species that impacts the poultry industry globally, with 100% morbidity and a high death rate due to serious injuries to the chickens' digestive⁴.

The Federal University of Agriculture, Abeokuta, developed the improved indigenous Nigerian chicken known as FUNAAB Alpha. This chicken is an improved breed of Nigerian local chicken breed and was developed through conscientious efforts of scientists at the Department of Animal Breeding and Genetics, Federal University of Agriculture, Abeokuta⁵. The breed was created using improved naked neck and frizzled feather chicken genotypes over 6 generations of selection and inbreeding, followed by 4 generations of crossbreeding with some exotic lines to enhance its growth and carcass quality⁵.

In both domestic and foreign breeds of chickens, coccidiosis has been identified as a severe parasitic disease with a significant economic impact^{4,6}. Both exotic (broilers, layers and cockerels) and Nigerian local chickens are susceptible to coccidiosis. However, the host's breed is one of the factors that influence how the host reacts to parasite diseases. Some animal breeds exhibit far greater resistance than others and can endure exposure to infections that would be fatal to other breeds⁷. This study focused on breed variations in body weight and immune response of improved Nigerian indigenous and exotic broiler chicken inoculated with attenuated *Eimeria tenella* vaccine.

MATERIALS AND METHODS

Experimental site: This research was conducted at the Poultry Unit of the Teaching and Research Farm of Ambrose Alli University, Ekpoma, Edo state. The experiment was laid out in a completely randomized design for a period of 8 weeks between July and September. The experimental birds consist of 200 broiler chickens of 2 breeds namely: Three strains of FUNAAB Alpha (normal feather, frizzle feather and naked neck) and one breed of exotic broiler (Arbor Acre). The FUNAAB Alpha also called improved Nigerian indigenous chicken was sourced from Pearl Farm, Federal University of Agriculture, Abeokuta Ogun State Nigeria while the Arbor Acre was purchased from a reputable hatchery in Ibadan, Oyo State.

Management of experimental birds: The birds were reared from the day old and brooded for a period of 3 weeks during which adequate ventilation, heat and humidity were ensured. The birds were reared in chick cage to prevent them from having contact with their droppings. They were wing-tagged for proper identification and subjected to the same management practices throughout the experimental period of 8 weeks. The birds were allowed access to commercial feeds and clean water *ad libitum*. The birds were fed starter and finisher mash, each containing 23% and 19% crude protein, from 0 to 4 and 5-8 weeks of age, respectively. To curb the spread of infectious diseases, the broiler chicken vaccination schedule was closely followed and proper sanitation was maintained.

Measurement of body weights: The body weights of the experimental birds were measured at 3 weeks before inoculation (on the inoculation day-day 0) and on days 1, 3, 6, 9, 12 and 15 post inoculation with *Eimeria tenella* vaccine. The body weight was measured in the morning before the birds were fed and it was done with Atom 'A' Camry digital scale with 0.01 g sensitivity.

Inoculation with *Eimeria tenella* vaccine: *Eimeria tenella* vaccine was purchased from National Veterinary Research Institute, Vom, in Plateau State, Nigeria. At 3 weeks of age, the experimental birds were

inoculated with *Eimeria tenella* vaccine, through oral inoculation at 100,000 (that is 1×10^5) doses per bird as specified by the manufacturer. All challenged birds were kept in battery cages to prevent them from having direct contact with their faeces.

Blood collection: Blood samples (1 mL) were collected with sterile needle and syringe from the wing veins of the experimental birds two days before inoculated with attenuated *Eimeria tenella* for base line study and also 7 days' post inoculation. The blood sample collected was transferred into tubes containing Ethylenediaminetetraacetic acid (EDTA) as an anticoagulant and labelled accordingly. The un-coagulated blood was used to determine Packed Cell Volume (PCV) by a microhaematocrit capillary tube using a hematocrit reader as described by Ezebo *et al.*⁸. The Red Blood Cell (RBC), White Blood Cell (WBC) and differential counts were analyzed immediately (not exceeding 24 hrs) after collection of blood using an automated cell counter⁸. Other haematological indices such as Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were calculated⁸.

Collection of faecal samples: Faecal samples were collected in polythene bags after inoculation from challenged chickens on days 1, 3, 6, 9, 12 and 15. The faecal samples were subjected to a simple floatation method and viewed under an electron microscope (OLYMPUS CH) for parasitological examination. The faecal oocyst load was determined using McMaster egg counting method. Mortality was recorded from day 1 to day 15 post-inoculation. At post-mortem, caecal lesion scores (LES) were assessed according to Johnson and Reid⁹, from 0 (no lesion) to 4 (most severe lesions). Mortality due to coccidiosis was scored 5. Preliminary analysis was carried out where homogeneity was tested.

Statistical analysis: The data collected on body weight, haematological parameters and lesion counts were analyzed for the effects of broiler genotype pre and post-inoculation. The analysis was done by using Analysis of Variance (ANOVA) using the General Linear Model (GLM) of the SAS 9.4 software (SAS Institute Inc., USA). Differences between means were separated using Duncan's multiple range and significance was considered at $p < 0.05$.

The model is:

$$Y_{ij} = \mu + G_i + \epsilon_{ij}$$

Where, Y_{ij} is the parameter of interest, μ is the population mean, G_i is the effect of i^{th} genotype on the parameter of interest ($i = 1, 2, 3, 4$) and ϵ_{ij} is the residual error.

RESULTS

Body weights of the experimental broiler as affected by genotype pre and post inoculation with *Eimeria tenella*: The body weights of FUNAAB Alpha and Arbor Acre broiler chickens as affected by genotypes pre (day 0) and post (days 1, 3, 6, 9, 12 and 15) inoculation with *Eimeria tenella* vaccine are shown in Table 1. The Arbor Acre broiler chicken had significantly ($p < 0.05$) highest body weight in all the day's considered pre and post inoculation with *Eimeria tenella*. However, comparable to the body weights of naked neck broiler chickens at days 1, 3, 9 and 12 post inoculation. The frizzle and normal feather broiler chickens had statistically similar body weights on all the days considered pre and post inoculation.

The haematological profile of improved Nigerian indigenous (normal feather, frizzle feather and naked neck) and exotic (Arbor Acre) broilers before inoculating with *Eimeria tenella* vaccine are shown in Table 2. There were no significant ($p > 0.05$) differences in all the haematological parameters studied except in Red Blood Cells (RBC), Lymphocytes (LYMP) and Mean Corpuscular Volume (MCV). The RBC was

Table 1: Body weights of the experimental broiler as affected by genotype

Post inoculation days	Genotypes	Body weight	Sample size
0	Naked neck	235.41±8.65 ^b	50
	Frizzle feather	212.60±8.65 ^c	50
	Normal feather	218.98±8.42 ^c	50
	Arbor Acre	279.91±8.30 ^a	50
1	Naked neck	391.00±8.65 ^a	50
	Frizzle feather	346.88±8.60 ^b	50
	Normal feather	336.13±8.42 ^b	50
	Arbor Acre	413.80±8.30 ^a	50
3	Naked neck	428.55±19.47 ^a	50
	Frizzle feather	409.92±19.18 ^b	50
	Normal feather	349.09±18.52 ^b	50
	Arbor Acre	442.49±18.60 ^a	50
6	Naked neck	460.14±28.02 ^b	50
	Frizzle feather	425.75±24.22 ^b	50
	Normal feather	402.55±21.23 ^b	50
	Arbor Acre	497.59±23.41 ^a	50
9	Naked neck	566.25±20.00 ^a	50
	Frizzle feather	481.15±20.00 ^b	50
	Normal feather	433.27±19.47 ^b	50
	Arbor Acre	547.69±19.18 ^a	50
12	Naked neck	671.44±46.52 ^a	50
	Frizzle feather	592.92±53.93 ^b	50
	Normal feather	556.95±52.57 ^b	50
	Arbor Acre	710.74±58.68 ^a	50
15	Naked neck	1057.14±48.52 ^b	50
	Frizzle feather	1002.75±48.52 ^b	50
	Normal feather	1010.42±47.24 ^b	50
	Arbor Acre	1308.59±46.52 ^a	50

Means in the same column with different superscripts ^{abc}Significantly different ($p < 0.05$) and \pm : Plus or minus standard error

Table 2: Haematological parameters of improved Nigerian indigenous and exotic (Arbor Acre) broiler chickens before inoculated with *Eimeria tenella* vaccine

Parameter	Normal feather	Frizzle feather	Naked neck	Arbor Acre
PCV (%)	30.75±6.42	31.00±1.79	27.50±2.71	29.25±3.56 ^{NS}
RBC ($10^6 \mu\text{L}^{-1}$)	2.71±0.67 ^a	2.55±0.20 ^{ab}	2.29±0.14 ^b	2.46±0.24 ^{ab}
Hb (g dL ⁻¹)	10.30±2.01	10.33±0.51	9.18±0.92	9.98±0.96 ^{NS}
WBC ($10^3 \mu\text{L}^{-1}$)	11.58±3.08	9.38±5.69	12.03±4.88	8.53±1.86 ^{NS}
HET (%)	28.00±7.39	32.00±3.99	30.50±2.14	30.50±4.28 ^{NS}
LYMP (%)	68.75±7.50 ^a	63.75±4.27 ^b	66.00±3.21 ^{ab}	65.50±4.17 ^{ab}
MONO (%)	1.25±0.65	2.00±0.99	1.25±0.37	1.25±0.99 ^{NS}
EOS (%)	1.00±0.53	1.00±0.65	1.00±0.65	1.00±0.75 ^{NS}
BAS (%)	1.00±0.53	1.25±0.37	1.25±0.83	1.50±0.37 ^{NS}
MCV (fL)	11.45±0.49 ^b	12.17±0.31 ^a	11.93±0.48 ^a	11.82±0.38 ^{ab}
MCH (pg/cell)	38.21±1.59	39.23±0.57	38.29±1.05	38.84±0.95 ^{NS}
MCHC (g dL ⁻¹)	33.47±0.69	33.39±0.21	33.34±0.11	33.67±0.44 ^{NS}

Mean in the same row with different superscripts ^{ab}Significantly different ($p < 0.05$), PCV: Packed Cell Volume, RBC: Red Blood Cell, HB: Haemoglobin, WBC: White Blood Cells, HET: Heterophils, LYMP: Lymphocytes, MONO: Monocytes, EOS: Eosinophils, BAS: Basophils, MCV: Mean Corpuscular Volume, MCH: Mean Corpuscular Hemoglobin, MCHC: Mean Corpuscular Hemoglobin Concentration, NS: Non-significance and \pm : Plus or minus standard error

significantly ($p < 0.05$) influenced with the highest value ($2.71 \times 10^6 \mu\text{L}^{-1}$) in normal feather broiler and the least found in the naked neck including frizzle feather and Arbor Acre broilers. The LYMP value was highest ($p < 0.05$) in normal feather broilers (68.75%) but similar ($p > 0.05$) to 66.00 and 65.50% obtained in the naked neck and Arbor Acre broilers respectively. The frizzle broiler had the least LYMP (63.75%), although not significantly ($p > 0.05$) different from naked neck and Arbor Acre broilers. The frizzle feather broiler recorded the highest ($p < 0.05$) value of MCV but not significantly ($p > 0.05$) different from the values obtained from naked neck and Arbor Acre broilers, respectively, while the normal feather broiler had the least MCV however similar ($p > 0.05$) to the value obtained from Arbor Acre broiler. Other haematological parameters examined are not significantly ($p > 0.05$) affected by the broiler genotype.

Table 3: Haematological parameters of improved Nigerian indigenous and exotic (Arbor Acre) broiler chickens after inoculated with *Eimeria tenella* vaccine

Parameter	Normal feather	Frizzle feather	Naked neck	Arbor Acre
PCV (%)	39.50±1.14 ^a	31.80±1.19 ^c	36.00±1.37 ^{ab}	32.75±1.37 ^{bc}
RBC (10 ⁶ µL ⁻¹)	3.31±0.09 ^a	3.19±0.24 ^{ab}	3.06±0.09 ^{ab}	2.80±0.11 ^b
Hb (g dL ⁻¹)	13.20±0.34 ^a	10.83±0.40 ^b	11.98±0.46 ^b	11.00±0.45 ^b
WBC (10 ³ µL ⁻¹)	11.08±0.75 ^b	12.85±0.69 ^a	13.68±0.37 ^a	10.30±0.55 ^b
HET (%)	35.50±1.50 ^a	33.05±1.54 ^{ab}	30.25±2.02 ^b	32.00±0.87 ^{ab}
LYMP (%)	61.25±1.62	64.80±1.29	66.00±2.17	64.50±0.86 ^{NS}
MONO (%)	1.00±0.20 ^b	2.30±0.30 ^a	1.85±0.20 ^a	1.25±0.31 ^b
EOS (%)	1.00±0.20 ^{ab}	1.55±0.29 ^a	0.75±0.20 ^b	1.25±0.20 ^{ab}
BAS (%)	1.25±0.12	0.80±0.35	1.25±0.20	1.00±0.20 ^{NS}
MCV (fL)	12.25±0.11	12.66±0.38	12.42±0.14	12.01±0.09 ^{NS}
MCH (pg/cell)	39.37±0.05	39.25±0.37	39.15±0.36	39.01±0.24 ^{NS}
MCHC (g dL ⁻¹)	33.48±0.14	33.36±0.22	33.49±0.07	33.57±0.16 ^{NS}

Mean in the same row with different superscripts ^{abc}Significantly different ($p < 0.05$), PCV: Packed Cell Volume, RBC: Red Blood Cell, HB: Haemoglobin, WBC: White Blood Cells, HET: Heterophils, LYMP: Lymphocytes, MONO: Monocytes, EOS: Eosinophils, BAS: Basophils, MCV: Mean Corpuscular Volume, MCH: Mean Corpuscular Haemoglobin, MCHC: Mean Corpuscular Haemoglobin Concentration, ±: Plus or minus standard error and NS: Non-significance

Table 4: Effect of genotype on lesion score of *Eimeria tenella* inoculated broiler chickens genotype

Genotype	Lesion score
Normal feather	3.64±0.33 ^b
Frizzle feather	2.24±0.40 ^b
Naked neck	2.42±0.22 ^b
Arbor Acre	6.45±0.50 ^a

Means in the same column with different superscripts ^{ab}Significantly different ($p < 0.05$) and ±: Plus or minus standard error

Table 3 shows the effect of genotype on the haematological profile of improved Nigerian indigenous (normal feather, frizzle feather and naked neck) and Arbor Acre broilers after inoculation with attenuated *Eimeria tenella* vaccine. The results showed that PCV, RBC, Hb, WBC, HET, MON and EOS were significantly ($p < 0.05$) influenced by the broiler genotype after inoculation with attenuated *Eimeria tenella* vaccine. The normal feather broiler had the highest ($p < 0.05$) PCV (39.50%) followed by similar ($p > 0.05$) value (36.00%) in naked neck broiler, which is also similar ($p > 0.05$) with the value (32.75%) in Arbor Acre while the frizzle feather broiler had the least (31.80%) PCV but was not different ($p > 0.05$) from the value in Arbor Acre broiler. The value of RBC was highest in normal feathers but similar to the values in frizzle and naked neck broilers. The Arbor Acre broiler had the least ($p < 0.05$) value of RBC however not significantly ($p > 0.05$) from the values in frizzle feather and naked neck. The Hb concentration was significantly ($p < 0.05$) affected by the broiler genotype after inoculation with the highest value in normal feather (13.20 g dL⁻¹) followed by 11.98, 11.00 and 10.83 g dL⁻¹ which are similar ($p > 0.05$) in the naked neck, Arbor Acre and frizzle feather broilers respectively. Further, there was a significant ($p < 0.05$) effect of genotype on WBC. The highest ($p < 0.05$) WBC was obtained in the naked neck (13.68 10³ µL⁻¹) and frizzle feather (12.85 10³ µL⁻¹) broilers while Arbor Acre and normal feather had statistically ($p < 0.05$) similar least values. The HET values were higher ($p < 0.05$) in normal feather broiler (35.50%) but also included ($p > 0.05$) frizzle feather (33.05%) and Arbor Acre broiler (32.00%). The least HET (30.25%) was found in the naked neck, although statistically ($p > 0.05$) the same with the values in the frizzle feather and Arbor Acre broilers. The MONO was affected ($p < 0.05$) by broiler genotype post-inoculation. The MONO followed a similar trend as WBC. The values of EOS obtained post-inoculation was highest ($p < 0.05$) in frizzle feather including ($p > 0.05$) Arbor Acre and frizzle feather broilers while the naked broiler had the least. The LYMP, MCV, MCH and MCHC were not significantly affected by the broiler genotype post inoculation with *Eimeria tenella* vaccine.

Table 4 shows the effect of genotype on the lesion score of *Eimeria tenella* inoculated broiler chicken genotypes. The results showed that genotype significantly ($p < 0.05$) influenced the lesion score of improved Nigerian indigenous and exotic broiler chicken with Arbor Acre having the highest ($p < 0.05$) lesion score (6.45) followed by normal feather broiler (3.64) with statistically ($p > 0.05$) similar values of 2.42 and 2.24 in the naked neck and frizzle feather broilers, respectively.

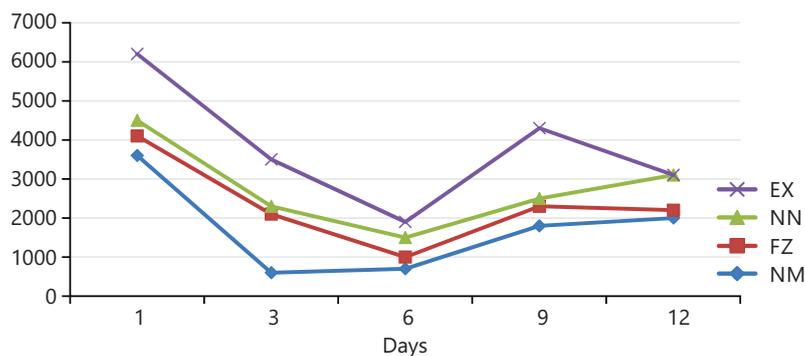


Fig 1: Oocytes counts of improved Nigerian indigenous and Arbor Acre broilers inoculated with *Eimeria tenella* vaccine

EX: Exotic broiler (Arbor Acre), NN: Naked neck broiler, FZ: Frizzle feather broiler, NM: Normal feather broiler, Y-axis (0-7000 oocyte counts per gram) and X-axis (Day 1-12: Days at post-inoculation)

Figure 1 shows oocyte counts of improved Nigerian indigenous and Arbor Acre broilers inoculated with *Eimeria tenella* vaccine. The oocyte counts showed three patterns. First, the number of oocytes decreased from day 1 through day 3 to day 6 post inoculations and thereafter increased from day 6 to the peak at day 9 in all the genotypes. The number of oocytes started declining from day 9 through day 12 of post-inoculation.

DISCUSSION

The body weight increases as the birds get older across the genotypes. The highest body weight recorded among the Arbor Acre may be attributed to the fact that they have been long selected for higher body weight and early maturity. However, the naked neck genotype had comparable weights with Arbor Acre broilers on all the days considered post-inoculation. This implies a higher concentration of exotic genes in naked neck broilers than in other genotypes of FUNAAB Alpha broilers. This demonstrated that if the naked neck broilers can be further improved and selected, it may successfully substitute Arbor Acre and other exotic broilers in tropical environments such as in Nigeria. Also, the rearing environment and management practices are the same for the four broiler genotypes, therefore differences or similarities in body weight among them could be attributed to genetic differences¹⁰. This was similar to the findings of Atansuyi *et al.*¹¹. In addition, Atansuyi *et al.*¹² reported that Marshall broiler has higher body weight than Nigerian indigenous broiler type chicken.

Hematological parameters have been observed as good indicators of the physiological status of the animal and their changes are important in assessing the response of such animals to various physiological situations¹³. In the current study, the results of haematological analysis showed that broilers used for the study were not affected by genotypes before inoculation with the *Eimeria tenella* vaccine except in LYMP and MCV. This suggests that the birds were healthy before challenged with *Eimeria tenella*. The present results of PCV and RBC values were in agreement with values given by Adenaike *et al.*¹⁴, where no significant genotype effect was observed in the PCV and RBC of Nigerian local chickens. However, variation in LYMP and MCV among the four genetic groups of broiler in this study may offer explanation for the defence mechanism of the birds. The existence of differences is an indication that the four genotypes can be ranked differently in terms of immunity and productivity. This implies that the birds were in good health prior to being exposed to *Eimeria tenella*. The current PCV and RBC values were consistent with those reported by Adenaike *et al.*¹⁴, who found no significant genetic effect in the PCV and RBC of local Nigerian chickens. However, differences in LYMP and MCV amongst the four broiler genetic groups of broilers in this study may provide a reason for the birds' defense mechanism. These discrepancies suggest that the four genotypes can be ranked differently in terms of resistance to disease and production. All the haematological values obtained before inoculation are within the ranges reported by Islam *et al.*¹⁵ and Simaraks *et al.*¹⁶ in chickens.

The post-inoculation hematological analysis revealed the highest values of PCV, RBC and Hb in a normal feather broiler. This was contrary to the report of El-Safty *et al.*¹⁷ that the naked neck gene improved PCV compared to that of the normal-feathered chickens. However, the higher values of PCV, RBC and Hb in normal feather broilers suggest better physiological functions including feed utilization and cellular respiration. The PCV is the relative quantity of cells compared to the total volume of blood¹⁸. The function of RBC is to transport oxygen from the lungs to tissues and remove carbon dioxide from the tissues to the lung in the body via haemoglobin¹⁹. Hemoglobin concentration is useful in detecting anaemia in avian species in general²⁰. The variations in these blood parameters among these genetic groups of *E. tenella* inoculated broilers can be used with other production traits to exploit the selection of improved Nigerian indigenous broilers for coccidiosis disease¹⁴. However, the values obtained in all the genotypes fell within the physiological range reported on chickens¹⁴⁻¹⁶. Generally, the values of WBC were higher in improved Nigerian indigenous broilers before and post inoculation with the highest values in the naked neck and frizzle feather broilers post-inoculation. The major functions of WBC and its differentials are to fight infections, defend the body by phagocytosis against invasion by foreign organisms and produce or at least transport and distribute antibodies in immune response²¹. Therefore, the higher and significant increase in WBC in improved Nigerian indigenous broilers before and post-inoculation suggests innate attributes to generate antibodies rapidly and defend the body against pathogenic organisms. Thus, it can be said that the improved Nigerian indigenous broilers are superior to Arbor Acre broilers in terms of survival in the coccidiosis disease environment. This may not be sufficient evidence, though, to categorize the genotypes as resistant or vulnerable to coccidiosis. Additionally, this study's average WBC counts across the various genotypes were consistent with the findings of Emenalom *et al.*²².

The lower intestine mucosa of the four genotypes contained *E. tenella* and the genotype had significant effects on the severity of the lesions. However, compared to normal feather, naked neck and frizzle feather broilers, a considerable number of *E. tenella* oocysts and clusters of big schizonts were seen in the Arbor Acre broiler, even though lesion score was probably not the best measure of immunological response to coccidiosis in this investigation. The caeca of the Arbor Acre broiler had a high quantity of oocysts and significant tissue damage, according to a pathological analysis of the caeca to assess the severity of the *E. tenella* infection on the broilers in this study. This outcome was consistent with the findings of Sharma *et al.*²³, who noted significant tissue loss, hemorrhage and disruption of the caecal glands. Chanie *et al.*²⁴ also reported similar in separate studies on *E. tenella*-infected local and RIR chickens and *E. tenella* and *Eimeria acervulina*-infected broiler chickens, respectively.

Despite having a comparative advantage in terms of body weight, this study found that Arbor Acre broilers are relatively susceptible to coccidiosis disease in the tropics. However, variations at the gene level may be necessary to accurately screen both FUNAAB Alpha and Arbor Acre broilers as being tolerant or susceptible to *Eimeria tenella* organism.

CONCLUSION

The body weights of Arbor Acre and naked neck broilers are comparable but higher than those of normal feather and frizzle feather broilers. There is variation in haematological responses to *E. tenella* challenged among the four broiler genotypes in this study. The normal feather broiler showed a better response in terms of PCV, RBC and Hb. Generally, all the haematological parameters examined were higher in improved Nigerian indigenous broilers. The oocyte counts and caecal and mucosa lesions were higher in Arbor Acre broilers. The improved Nigerian indigenous broilers especially the naked neck genotype can be selected against coccidiosis in the tropics. However, more factors (such as antibody titre and cytokine levels) can be investigated as coccidiosis immune response traits to ascertain the response of improved Nigerian indigenous and Arbor Acre broilers to coccidiosis.

SIGNIFICANCE STATEMENT

Genetically resistant breed of broiler chicken to coccidiosis have not been reported in tropical environments and yet coccidiosis is an endemic disease of chicken in the tropics. Therefore, the results obtained in this study can form the basis for selection of resistant breed of broiler chicken in the tropics. This study provided insight into the comparable weights of FUNAAB Alpha and Arbor Acre broiler chickens and their immune-competence against coccidiosis. In addition, the information provided on haematology can be used as diagnostic tools for assessing the health of FUNAAB Alpha and Arbor Acre broiler chickens in a coccidiosis prevalent environment.

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