



Haematological Responses of Broiler Chickens Fed Garlic-Based and Ginger-Based Diets

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ABSTRACT

Haematological responses of broiler chickens fed garlic-based and ginger-based diets were investigated. One hundred and twenty chicks were used in the investigation. The chicks on arrival at the site of study were brooded and similarly managed for 4 weeks to fully adapt them to their environment. At the end of the 4 weeks brooding period, the birds were randomly assigned to four dietary treatments of 30 birds/treatment and 3 replicates of 10 birds/replicate as: control or treatment 1 (T1, contained no garlic or ginger), treatment 2 (T2, contained 10g of ginger), treatment 3 (T3, contained 10g of garlic) and treatment 4 (T4, contained 5g of garlic + 5g of ginger)/kg of diet. The animals were fed these garlic-based and ginger-based diets for 4 weeks. 9 birds from each treatment group were sacrificed and their blood collected into treated ethylene diamine tetra-acetic acid (EDTA) tubes for analyses for: packed cell volume (PCV), haemoglobin (Hb), red blood cell (RBC), white blood cell (WBC) and their differentials: neutrophil (NEU), lymphocytes (LYM), monocytes (MON), eosinophils (EON) and basophil (BAS). There were no differences ($P > 0.05$) in the PCV and RBC for all treatment groups. T4 significantly ($P < 0.05$) had lower value of Hb compared to T1, T2 and T3 birds that had similar ($P > 0.05$) higher values. Furthermore, birds of T2 had significantly ($P < 0.05$) highest count of WBC whereas T1 and T3 animals had similar counts with T4 animals showed significantly ($P < 0.05$) the lowest count. However, all the positive control treatment groups had significantly ($P < 0.05$) higher values compared with the T1. It was concluded that dietary ingestion of garlic and ginger improved some haematological parameters of broiler chickens, such as WBC, LYM and OEN.

INTRODUCTION

Blood parameters are often used as one of the major factors in determining the nutritional status of a living organism, including farm animals such as poultry. Therefore, changes seen in the constituents of blood when compared to the control values can be used to explain in part the metabolic state of an animal as well as the quality of the feed ingested by the animal (Babatunde *et al.* 1992). Again, Ekenyem and Madubuike (2006) showed that haematological data can be used to ascertain the disposition of the animal to its nutrition.

To this extent, literature data have shown that nutrition in regards to kinds of feed ingested by the animal can significantly affect blood characteristics of animals. Accordingly, the data of Saita (1974) demonstrated that a diet with some levels of benzene when fed to animals induced leukemia, erythropenia, neutrophilia, lymphocytosis and alterations in blood platelets' morphologies. These findings by Saita (1974) strongly support the just stated facts. Furthermore, Ovuru and Ekweozor (2004) reported similar observations that the diets fed to rabbits in their studies resulted in decreased erythrocytes, platelets and packed cell volumes.

On the other hand, Johnson *et al.* (2019) showed that dietary vitamins improved PCV levels, Hb, RBC and WBC counts in the pig as well as neutrophils and lymphocytes. Again, Okejim *et al.* (2020) observed that vitamin ingestion ameliorated the negatives indices of the haematological properties of pigs initially fed diets contaminated with crude oil. From these observations, it is not a gainsaying to state that dietary nutrition additives have great impact on the overall health and wellness of the animal and therefore necessitated the design of this current study. Therefore, the objectives of this study are to investigate the effects of garlic and ginger on the PCV, Hb and RBC counts in broiler chickens as well as the effects of garlic and ginger on WBC counts and its differentials, namely: neutrophils, lymphocytes, eosinophils, monocytes and basophils.

MATERIALS AND METHODS

Experimental site: This study was carried out at the poultry unit of the Teaching and Research Farm, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt. The farm is situated at latitude 4° 48'N and longitude 6° 48'E at the Rivers State University campus.

Animals: One hundred and twenty (120) CHI day-old chicks were acquired from a reputable commercial poultry dealer in Port-Harcourt, Rivers State. The animals on arrival at the Rivers State University Teaching and Research Farm were brooded to properly pre-condition them to their new environment. The animals by the fourth week were observed to have

properly adapted to their environment and thus were randomly assigned into four treatment groups of 30 birds/treatment group with 3 replications of 10 birds/replicate. The pens were properly cleaned and disinfected before the birds' arrival. Feeders and drinkers were also properly cleaned to also ensure that the animals' environment were "pathogen-free". During the brooding period all protocols, including the necessary medications were provided. Animals were fed similar diets from day one through the end of the 4th week. Water was provided *ad libitum*. The experiment lasted for 8 weeks in total as the animals received their respective experimental diets for 4 weeks.

Experimental Diets: Top feed™ grower mash feeds were used in the study. In other words, the diets fed to the animals during the last four weeks of the experimental period were similar in all nutrients except that the test ingredients as: control or treatment 1 (T₁, contained no garlic or ginger), treatment 2 (T₂, contained 10g of ginger), treatment 3 (T₃, contained 10g of garlic) and treatment 4 (T₄, contained 5g of garlic + 5g of ginger)/kg of diet, respectively. The animals were fed these levels of the garlic-based and ginger-based diets for 4weeks.

Blood Sample Collection: At the end of the study period, nine (9) birds from each treatment group were bled for blood collection. Three (3) birds were randomly collected from each replicate of the four treatment groups. The blood was collected from each of the bird into treated sample tubes with ethylene diamine tetra-acetic acid (EDTA) and immediately snap frozen for later haematological analyses.

Blood Analyses: Blood samples were analyzed by haematology auto-analyzer machine (BC-2300). Blood parameters analyzed for were: PCV, RBC count, Hb concentration, total and differential WBC counts of each treatment group.

Experimental design and Statistical analyzes: The study was designed and carried out as a completely randomized design (CRD). Data obtained were subjected to analysis of variance (ANOVA) using general linear model (GLM) procedure of SAS. Treatment means were compared using Tukey's test. The model was: $Y_{ij} = \mu + X_i + E_{ij}$, where Y_{ij} = individual observation of the treatment, μ = population mean, X_i = effect of the i^{th} treatment and E_{ij} = the error term. An α -level of 0.05 was used for all statistical comparisons to represent significance.

RESULTS

The results of the PCV, Hb and RBC counts of broiler chickens that were fed garlic-based and ginger-based diets are shown in Table 1.

Table 1. Means values of PCV, Hb and RBC of broiler chickens fed garlic-based and ginger-based diets

Item	TREATMENTS				SEM	P-value
	T ₁	T ₂	T ₃	T ₄		
PCV (%)	36.56	36.56	36.33	37.69	0.50	1.00
Hb (g/dl)	13.67 ^a	13.67 ^a	13.76 ^a	12.56 ^b	0.35	0.02
RBC (ul ³)	5.44	5.44	5.44	5.66	0.25	0.97

^{a,b}Means within each row with different superscripts differ significantly ($P < 0.05$)

As shown in Table 1, the PCV of the T₁, T₂, T₃ and T₄ animals' treatment groups were ($P > 0.05$) similar as there were no significant ($P > 0.05$) differences amongst all animal treatment groups. For the haemoglobin concentration, animals of the T₁, T₂ and T₃ groups were similar as there were no significant

($P > 0.05$) differences among them but were significantly ($P < 0.05$) higher compared with animals of T₄ group. There were no differences ($P > 0.05$) in the RBC counts amongst the four treatment groups. The results of the WBC count and their differentials are shown in Table 2.

Table 2. WBC count and their differentials of broiler chickens fed garlic- and ginger-based diets

Item	TREATMENTS				SEM	P-value
	T ₁	T ₂	T ₃	T ₄		
WBC (ul ³)	10.90 ^b	13.05 ^a	11.04 ^b	9.92 ^c	0.12	0.000
Neu (%)	35.33 ^a	31.33 ^b	30.33 ^b	31.67 ^b	1.02	0.01
Lym (%)	55.78 ^b	58.33 ^{ab}	60.33 ^a	60.00 ^a	1.40	0.01
Eon (%)	2.89 ^a	3.89 ^b	3.56 ^b	2.00 ^c	0.31	0.04
Mon (%)	6.00	6.44	5.78	6.33	0.61	0.70
Bas (%)	-	-	-	-	-	-

^{a,b,c}Means within each row with different superscripts differ significantly ($P < 0.05$)

As shown in Table 2, there were significant differences ($P < 0.05$) in WBC counts as well as in the neutrophils, lymphocytes and eosinophils amongst treatment groups. For the WBC counts animals in the T₂ treatment group showed significantly ($P < 0.05$) the highest value whereas T₁ and T₃ groups had similar ($P > 0.05$) values with T₄ showed the lowest value.

DISCUSSION

The wholesomeness and thus lack of deviations from normal blood morphologies and levels are indicators of the effectiveness of the dietary natural antioxidants, especially ginger in the synthesis of antioxidant molecules for maintaining good health of the animals that ingested them. However, in this current study garlic and ginger had no effects on most of the blood parameters studied. Nevertheless, ingested dietary garlic and ginger improved the WBC counts but not their combinations. This might not be unconnected to the antibacterial, antiviral, antifungal, and the anti-parasitic properties of garlic and ginger (Tsai *et al.*, 2006). Blood is always used to assess the animal in terms of animal health, performance indices and thus profitability. To this point, therefore, garlic and ginger improved the animal production indices as observed in

this study via performance parameter indices collected as part of the study. This finding in this study is in agreement with the data of other independent workers, such as those of Oluwole (2001) and Kommera *et al.* (2006). Phytobiotics, such as garlic and ginger and especially ginger are implicated in the overall wellness of the animal and hence increased performance and other economic indices by the findings of this study.

As previously given, blood parameters are one of the major indices of measuring or determining the nutritional status of any living organism, including poultry. Therefore, changes observed in the blood constituents when compared to the control, for instance the T₁ group values in this current study could be used to explain at least in part the metabolic state of the animal as well as the quality of the feed of the animal (Babatunde *et al.* 1992; Ekenyem and Madubuike, 2006). Ekenyem and Madubuike (2006) demonstrated that haematological parameters can be used to gain more insights about an animal and consequently to their plane of nutrition. This assertion becomes more dependable as it has been further shown that haematological parameters are affected by factors like nutrition, environment and health condition of the animal (Menzel, 1992; NRC, 2012).

One major take away from this current study was the fact that animals that received garlic and ginger

had higher values of lymphocytes. This observation in this study supports the fact that garlic and ginger are capable of enhancing the quality of lives of broiler chickens (De la Fuente and Victor, 2000). Furthermore, WBC counts of the ginger-based diet animal group were significantly enhanced compared with other dietary treatment groups, including the control group.

Overall, when the findings of this study is further interpreted, it demonstrates that garlic and ginger intake can stimulate a protective immune response that can be adequate to induce resistance to pathogens and possible other environmental factors that can cause ill-health. To this point, the finding of this study is in tandem with previous researchers' works, such as those of De la Fuente and Victor (2000) and Fragou *et al.* (2004).

CONCLUSION

Dietary ingestion of garlic and ginger improved some haematological parameters of broiler chickens. Specifically, garlic and ginger can be added at 10g/kg of diet for broiler chickens to improve the broiler hematological characteristics, particularly WBC, LYM and OEN to enhance their quality of lives.

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