PHENOTYPIC RESPONSES OF TWO BROILER BREEDS OF CHICKENS TO CLOVE SUPPLEMENTATION UNDER HEAT STRESS

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ABSTRACT
The present study investigated evaluation of impact of clove supplementation on growth performance traits of two broiler breeds of chicken raised under heat stress condition. The study was conducted at the Federal University Gashua, Yobe State. The parameters studied were intestinal weight, intestinal length, liver weight, heart weight and gizzard weight, carcass and haematological parameters. Breed and clove supplementation significantly (P<0.05) affected growth performance of the broiler chickens at week 5 and 6 but not at week 6. No significant difference was noticed in all the blood parameters analysed except in MCU, PLT and PCV where significant (P<0.05) effects of clove were observed. However, the interaction effect of breed and clove were noticed in WBC and Hb. Our results, therefore, revealed that genetic make-up of broiler breed of chicken affected their phenotypic responses to clove treatment under heat stress and this could be attributed to nutrigenomic effect of clove on the expressions of genes of adaptive traits.
Keywords: Broiler chicken, Breeds, Clove, Nutrigenomics, Growth performance

INTRODUCTION
The productions and performances of broiler chickens are usually hindered by various stresses including those related to heat stress (Badmus *et al.,* 2022) and chronic stresses (Badmus *et al.*, 2021). Stress is the nonspecific response of the body to any demand, whereas stress can be defined as an agent that produces stress at any time (Selye, 1976). Environmental stressors, such as heat stress, are particularly detrimental to animal agriculture (Nienaber and Hahn, 2007). It has been suggested that modern poultry genotypes produce more body heat, due to their greater metabolic activity (Deeb and Cahaner 2019). It is obvious that, within the livestock sector, the poultry industry has gained an active and leading role in most regions of the world. Many strategies have been developed to ensure heat stress free conditions in broiler chicken enterprises to ensure high production. Among the strategies employed by most researchers are the housing system (Badmus *et al.*, 2022) and nutrigenomic approach which includes inclusion of antioxidants in the diet and water of the broiler chickens to adjust to climatic condition (Tawfeek *et al.,*2014). The use of clove as antioxidant have been proven positive in mitigating the inimical effect of heat stress condition in chicken. Cloves (*Syzygium aromaticum*) are aromatic flower buds from an evergreen tree belonging to the Myrtaceae plant family (Mbaveng and Kuete, 2017). Nutrigenomics is a detailed study of how nutrition alters gene expression or responses of breeds to nutrition due to their genetic make-up. There is little or no information on how cloves affect phenotypic traits due to genetic make up in broiler chickens. This study, therefore, was designed to determine the nutrigenomic response of breeds of chicken to clove supplementation.

MATERIALS AND METHODS
Experimental birds and management
The experiment was carried out during the 2023 dry season where temperature is extremely high at the teaching and research farm of the Department of Animal Science, Federal University Gashua, Yobe State. A total of one hundred (100) day-old of fifty (50) Abor acre and fifty Cobb of broiler chicks purchased from a reputable Hatchery were used for this study and subjected to 2x2 factorial design of CRD each (clove and non-clove). On arrival, the chicks were weighed and randomly assigned into two treatment and replicated three times where each treatment carried 16 birds x 3 where T1 of each breed was administered diet with supplemented clove as an antioxidant (400mg/kg of diet) and T2 was given normal feed which serves as control respectively. The experiments lasted for six weeks.

Performances and blood collection
Bird weights per pen were measured at placement and then every week thereafter using electronic weighing scales. Three birds per treatment were chosen at random and starved of feed for 24 hours. The birds were weighed and humanely slaughtered with sharp knives at week six. The bloods were collected

into EDTA (Ethylene di-ethyltetraacetic acid) tubes and kept in the -20ºC refrigerator until use. The blood haematological parameters were measured in the specialist hospital, Gashua, Yobe state.

Statistical analyses

Data on body weight, visceral organ weight (absolute and relative) were subjected to procedure of general linear model (Proc glm) of SAS (2002). Mean differences were separated using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Growth performance of breed of broiler chicks fed in clove under Heat Stress

The result on growth performance of breed of broiler chicks fed in clove under heat stress is presented in Table 1. Breed and clove supplementation significantly (P<0.05) affected growth performance of the broiler chickens at week 5 and 6 but not at week 6. Cobb broiler breed revealed significantly (P<0.05) higher body weight than Arbor acre breed at wee6. Clove significantly (P<0.05) affected body weight of Arbor acre breed at week 6. Higher (P<0.05) of clove was observed in Cobb breed than in Arbor acre. Al-Batshan *et al.* (2015) investigated the effect of adding clove extract to the diet of broiler chickens raised under heat stress conditions and their results showed that the addition of clove extract improved weight gain, feed conversion ratio and carcass characteristics. The authors attributed these positive effects to the antioxidant properties of clove, which helped reduce oxidative stress caused by heat stress. Some nutrients alter gene expression in organism and thereby giving rise to each receptor capacity of binding to a nutrient signaling molecule and initiating adaptive change (Reen *et al.*, 2015). The current results did not agree with those of Mohammadi *et al.* (2014), who found that broilers supplemented with clove (100 mg/kg, 300 mg/kg, and 500 mg/kg) did not grow linearly and had decreased growth performance and total feed intake with the addition of 500 mg of cloves/kg of diet. The results of the effects of clove supplement on Haematological parameters presented in Table 2. No significant difference was noticed in all the blood parameters analysed except in MCU, PLT and PCV where significant (P<0.05) effects of clove were observed.

Table 1: Growth performance of breed of broiler chicks fed in clove under Heat Stress

	Body weight (g)		
Breed	**Week 3**	**Week 5**	**Week 6**
Arbor Acre			
Clove	1440.9±4.65	1704.0^{b}±2.75	1760.0 ^{b}±5.7
No clove	1424.0±48	1666.5 ^{c}±4.12	1733 ^{c}±3.33
Cobb			
Clove	1440.8±8.40	1769.0 ^{a}±2.45	1810 ^{a} ±16.5
No clove	1445.4±4.59	1708.4 ^{b}±2.67	1785 ^{a}±4.28
Breed	0.0798	<.0001	<.0001
Treatment	0.3126	<.0001	0.0106
Breed x treatment	0.0777	0.0003	0.9285

^{abc}: show along the column means they are significance (p > 0.05) differences and (p< 0.05) shows no significant difference along the column

Table 2: Mean (+SE) of hematological parameters of two broiler breed fed with and no clove supplement diet

Breed	WBC	LYM	GRA	RBC	Hb	HCT	MCT	PLT	PCV (%)
Arbor acre									
CLOVE	89.74±1.29	75.83±1.02	6.49±0.52	2.43±0.09	7.83±0.29	30.78±1.42	124.47^{a}±3.34	169.67^{a}±18.25	0.125^{a}±0.01
NO clove	89.17±2.80	77.02±2.20	5.93±0.76	2.64±15	9.20±0.27	34.27±1.32	126.17^{a}±4.62	114.50^{b}±9.32	0.08^{b}±0.01
COBB									
CLOVE	104.33±3.59	81.01±2.77	12.97±4.58	2.77±0.21	9.02±0.28	28.82±5.32	126.03^{a}±2.01	155.33^{a}±17.09	0.12^{a}±0.01
NO CLOVE	90.79±7.02	74.31±3.15	9.55±4.78	2.25±9.28	8.55±0.28	30.71±2.43	111.21^{b}±17.29	121.00^{b}±26.99	0.08^{b}±0.02
Breed	0.07	0.61	0.15	0.92	0.35	0.47	0.84	0.8386	0.94
Treatment	0.11	0.27	0.56	0.44	0.12	0.48	0.03	0.0286	0.02
Breed X Treatment	0.01416	0.1195	0.6724	0.0797	0.0034	0.3780	0.5891	0.5891	0.8799

WBC=White blood cell; LYM = Lymphocyte, GRA =Granulocyte; RBC = Red blood cell; Hb = hemoglobin; HCT = Hematocyte; MCT = Melanocyte; PLT = Platelete; PCV = Pack cell volume

However, the interaction effect of breed and clove were noticed in WBC and Hb. Research by Al-Mashhadani *et al.* (2019) reported that supplementation of clove powder at a dose of 1% in the diet of broilers raised under heat stress conditions significantly increased the WBC count compared to the control group. This may indicate an improved immune response in the birds due to expressions of certain genes of adaptive responses. The gene expression is modified by numerous nutrients such as macronutrients (e.g. carbohydrates, proteins, fats), vitamins and minerals (e.g. Fe, Ca, Se, Zinc), and phytogenic compounds (Reddy *et al.*, 2018). Al-Mashhadani *et al.* (2019) found that clove supplementation had no significant effect on RBC and Hb count in broilers raised under heat stress conditions. A study by Patra *et al.* (2015) reported that supplementation of clove essential oil at a dose of 0.5 ml/kg of feed in the diet of broilers raised under heat stress conditions significantly increased the platelet count compared to the control group. This may indicate an improvement in blood clotting ability in birds. The same research by Patra et al. (2015) found that clove essential oil supplementation had no significant effect on PCV in broilers raised under heat stress conditions. The haematological data reported in this study revealed that Hb, MCU, PLT and PCV could be used as biomarkers of physiological data in predicting animal wellbeing. This assertion however disagreed with the report of Rushen, 1991 and Fairhurst *et al.* (2013) who reported that the use of haematological parameters are not reliable as biomarkers of physiological data in predicting animal health and wellbeing due to their inconsistencies.

CONCLUSION

In this study, we discovered that clove supplementation and breeds affected growth performances, carcass traits, organs weights and haematological parameters. Depending on the traits and the parameters, both the breeds revealed genetic differences in their phenotypic responses to clove treatments. This revealed that genetic make-up of broiler breeds of chicken affected their phenotypic responses to clove treatment under heat stress and this could be attributed to nutrigenomic effect of clove on the expressions of genes of adaptive traits. Therefore, clove treatment improved the improved growth performance of the fed broiler chicken and could be used for nutrition strategies for broiler adaptation to heat stress condition.

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