

EFFECT OF DIET SUPPLEMENTED WITH BLACK PEPPER (*Piper nigrum*) ON THE HAEMATOLOGICAL INDICES OF STRESS-INDUCED STARTER BROILER CHICKENS

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ABSTRACT

This study aimed to determine the effect of black pepper supplemented diets on the haematological indices of starter broiler chickens induced with corticosterone. It was found that broiler chickens fed diets supplemented with black pepper (BP) at 6 g/kg without corticosterone or vitamin C at 2 g/kg with corticosterone had the highest Haemoglobin levels. Red blood cells were highest in birds fed BP at 6 g/kg without corticosterone and BP at 12 g/kg with corticosterone. Lymphocyte levels were highest in birds receiving vitamin C at 2 g/kg, regardless of corticosterone. The highest heterophil and heterophil-to-lymphocyte (H/L) ratio values were observed in birds fed the control diet that is, without corticosterone and BP at 6 g/kg with corticosterone. Overall, supplementation with vitamin C and black pepper, with or without corticosterone, did not adversely affect the health parameters of the broiler chickens.

Keywords: Broiler chickens, Black pepper, Vitamin C, Corticosterone

INTRODUCTION

Broiler production is one of the fastest growing sectors of livestock industry in developing countries. Generally, stress has been a threat to poultry industry therefore, it is important to look out for solutions to these problems of which phytoegenic supplement like black pepper will be of great solution. Stress in broilers could be as a result of metabolic, hormonal, and immune system changes suffered by the birds when they are unable to dissipate sufficient body heat to the environment due to unsuitable conditions (Antonio *et al.*, 2019). Environmental variation is another factor that affects the sustainability of livestock production systems in tropical climate (Sinha *et al.*, 2017). Climate variation is a global issue and its effects on every activity of poultry is enormous irrespective of the location. (Demeke, 2004). Bonnet *et al.* (1997) discovered that exposure to environmental stress during the growing period of broilers has been coupled with undesirable meat quality and adverse effects on behaviour, welfare and immunity of poultry resulting in massive economic losses of farmer.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the poultry unit of the Institute of Food Security Environmental Resources and Agricultural Research (IFSERAR), Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State, Nigeria. The experimental site is located in the humid tropical zone of South-Western Nigeria with minimum and maximum temperatures of 20.66 and 35.48°C respectively. It lies in the region 76m above sea level and falls within latitude 7.2297°N, 3.4392°E. It receives a mean precipitation of 1037mm per annum.

Sourcing and Processing of Test Ingredients

Dried black pepper was sourced from an open market in Abeokuta, Ogun State, Nigeria and ground to powder with the aid of a plate mill. The powder was packed in a bag and stored properly until usage in the mixing of feed. Black pepper was mixed with the feed in appropriate doses to form a homogenous mixture. Vitamin C and Corticosterone was purchased from Ibadan, Oyo state, Nigeria.

Experimental Animals and Management

A total of 320, day-old broiler chicks were sourced from a reputable hatchery in Ibadan, Oyo State, Nigeria for this study. They were raised on a deep litter system and allotted into 32 compartments with each compartment containing 10 broiler chicks. From day-old to 14 days (2 weeks), the chicks were brooded. Feed and water were provided *ad-libitum* for four weeks.

Experimental Design

The experimental design was laid out in a 4 × 2 factorial arrangements of four dietary treatments (basal diet serving as the control, basal diet supplemented with 2g Vitamin C per kg diet, basal diet supplemented with black pepper at 6g/kg diet and 12g black pepper per kg diet) and two corticosterone levels (0.00 and 0.5g/kg). Three hundred and twenty-one-day old starter broiler chickens were allotted into eight (8) treatments, with each treatment having four (4) replicates in a completely randomized design. The birds were housed under similar conditions of temperature and humidity for six weeks.

Statistical Analysis

Data collected were analysed using Statistical Analysis Software (SAS 2000) package. Significant differences among treatment means at ($p < 0.05$) were determined using Tukey's Studentized Range (HSD) Test.

Table 1: Interaction effects of corticosterone and dietary supplements (vitamin C and Black pepper) on the haematological indices of stress-induced starter broiler chickens

Parameters	Without Corticosterone				With Corticosterone				SEM	p-Value
	Control	Vitamin C (2g/kg)	BP (6g/kg)	BP (12g/kg)	Control	Vitamin C (2g/kg)	BP (6g/kg)	BP (12g/kg)		
PCV (%)	33.00 ^{bc}	30.00 ^e	34.50 ^{ab}	33.00 ^{bc}	31.00 ^{de}	32.50 ^{cd}	31.50 ^{cde}	35.50 ^a	0.37	<0.0001
HB (g/dl)	11.07 ^{bc}	11.45 ^{abc}	12.35 ^a	11.55 ^{abc}	11.75 ^{abc}	11.85 ^{ab}	10.55 ^c	11.35 ^{abc}	0.13	0.0080
RBC ($\times 10^{12}/L$)	2.77 ^{ab}	2.75 ^{ab}	3.05 ^a	2.40 ^b	2.50 ^b	2.75 ^{ab}	2.70 ^{ab}	3.05 ^{ab}	0.06	0.0087
WBC ($\times 10^9/L$)	12.50	12.65	14.00	12.70	13.10	12.35	12.10	13.60	0.19	0.1198
HET (%)	30.50	28.00	28.50	29.00	27.50	27.50	29.50	28.50	0.32	0.2553
LYM (%)	66.00 ^b	71.00 ^a	70.50 ^a	69.00 ^{ab}	69.50 ^{ab}	70.50 ^a	68.50 ^{ab}	70.00 ^a	0.39	0.0124
HL	0.46	0.39	0.41	0.42	0.39	0.39	0.43	0.41	0.01	0.1077
EOS (%)	1.50 ^a	0.50 ^{ab}	0.50 ^{bc}	0.50	1.00 ^{ab}	0.50	0.00 ^b	1.00 ^{ab}	0.11	0.0100
BAS (%)	0.50 ^{ab}	0.00 ^b	0.00 ^b	0.00 ^b	0.50 ^{ab}	1.00 ^a	0.50 ^{ab}	0.00 ^b	0.09	0.0065
MONO (%)	1.50	0.50	0.50	1.50	1.50	0.50	1.50	0.50	0.14	0.0195
MCV (fl)	121.00 ^{ab}	109.06 ^b	114.82 ^{ab}	138.46 ^a	124.36 ^{ab}	118.19 ^{ab}	117.45 ^{ab}	116.76	2.34	0.0610
MCH (pg)	40.64	41.58	41.09	48.59	47.02	43.10	39.39	37.33	0.98	0.0338
MCHC (g/dl)	33.48 ^{bc}	38.09 ^a	39.79 ^{ab}	35.00 ^{abc}	37.89 ^a	36.48 ^{ab}	33.48 ^{bc}	31.97 ^c	0.49	0.0002

abcde= means on the same row with different superscripts is significantly different ($p < 0.05$), BP= Black Pepper, PCV= Packed cell volume, HB= Haemoglobin, WBC= White Blood Cell, RBC= Red Blood Cell, HET= Heterophils, LYM= Lymphocytes, HL= Heterophils to Lymphocytes ratio, EOS= Eosinophils, BAS= Basophils, MONO= Monocytes, MCV= Mean Corpuscular Volume, MCH= Mean Corpuscular Haemoglobin, MCHC= Mean Corpuscular Haemoglobin Concentration, SEM= Standard error of mean

RESULTS AND DISCUSSION

This study examined the impact of corticosterone and dietary supplements on the health of starter broiler chickens. The packed cell volume (PCV) values for all diets, including those with corticosterone, were within the normal range of 22-33% as reported by Banerjee (2009). Haemoglobin (Hb) levels also fell within the normal range of 7-13 g/dl, suggesting that corticosterone did not induce anemia (Banerjee, 2009). Both red blood cells (RBC) and white blood cells (WBC) were within the normal ranges (RBC: $2-4 \times 10^{12}/L$; WBC: $9-34 \times 10^9/L$), indicating proper oxygen transport and immune function (Banerjee, 2009; Swenson, 1970; Mitraka and Runsley, 1977; Campbell et al., 2003; Isaac et al., 2013). White blood cells supported immune defence, while mean corpuscular volume (MCV), mean corpuscular Haemoglobin (MCH), and mean corpuscular Haemoglobin concentration (MCHC) values were mostly normal, suggesting the diets were protein-rich (Saladin, 2003; Osman et al., 2004). However, MCHC values deviated for specific diet combinations, notably those with vitamin C and black pepper. The study concludes that corticosterone and dietary supplements, including black pepper and vitamin C, do not adversely affect the health parameters of broiler chickens.

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