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PHYSIOLOGICAL RESPONSES OF LAYING BIRDS FED HONEY AND VITAMIN C IN DRINKING WATER

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Abstract

The continuous challenge of climate and its impact on livestock with the resultant threats in food security has necessitated the need to mitigate the effect of stress resulting thereof on the physiological response of layers. This study was designed to investigate the effect of honey and vitamin C fed to layers in drinking water, on the physiological response, egg quality characteristics, hematology and serum biochemistry of the layers. One hundred and twenty Shika brown layers were randomly divided into four treatment groups of 30 layers, each replicated three times with 10 layers per replicate, in a completely randomized design (CRD). The groups were fed four diets containing 0 ml (only water), 200 mg/litre (vitamin C), 10 ml honey and 20 ml honey representing treatments 1, 2, 3, and 4, respectively for 84 days. The measurements taken include the heart and respiratory rate, 4 hourly rectal temperature, internal and external egg characteristics and blood samples. Layers on T_1 recorded the highest mean value of 114.6 beats per minutes (bpm) and 48 bpm for HR and RR, respectively. Layers on T_4 was superior to those on T_1 with regard to egg hen day production (80.9%) and egg weight (60.3g) as against (53.3%) and (53.66g) for T_1. The hematological profile viz; hemoglobin (Hb), PCV, RBC and WBC differential counts was significantly ($p<0.05$) influenced by the treatments. Layers on T_4 recorded the PCV (31.0%), Hb (8.33gl), and RBC (2.53/µl) than T_1, PCV (25.65%), Hb (6.239gl) and RBC (2.11/µl). The result on serum biochemistry showed that there were significant differences among treatment means in respect to total proteins (3.79g/dl), Albumen (1.30g/dl), Globulin (2.49g/dl), urea (7.89mg/dl), calcium (10.96m/dl), cholesterol (138mg), potassium 6.60mmol/dl and glucose 212mg/dl in favour of T_4. It is therefore concluded that inclusion of honey at 20% level of inclusion did not show any deleterious effect and could be used to elicit positive physiological responses on layers to stress condition and improve egg characteristics.

Key words: Honey, Vitamin C, Layers, Heart rate and Respiratory rate.

INTRODUCTION

Over the years, the high cost of conventional sources of vitamins, proteins and minerals has necessitated the increasing use of locally available leaves from shrubs and other plants abundantly found in Nigeria.

However, heat stressed flocks often lays eggs with thinner, weaker shells because of acid/base disturbance in the blood as a results of panting (Coutts and Wilson, 1990). Other stress or disturbances such as day-length, movement and nutrition to a flock of laying hens can be enough to de-synchronize the process of egg formation. During hot periods, birds pant to reduce heat stress. As the hen pants to reduce body heat, there is excessive loss of CO_2 gas from the blood (Butcher and Miles, 2003). Lower CO_2 concentration causes blood pH to elevate or become more alkaline. The higher blood pH reduces the amount of ionized calcium and carbonate delivered to the uterus for egg shell formation. Increasing the amount of antioxidant in the feed or drinking water could correct the problem. Birds usually have limited physical resources for growth, reproduction, response to environmental change and launching defence mechanisms (Khan *et al.,* 2011). Continuous stress causes fatigue and weakness and consequently, affected birds are more likely to succumb to starvation and infectious diseases. It was against this background that the physiological responses of laying birds fed honey and vitamin C in drinking water was investigated.

MATERIALS AND METHOD

This experiment was conducted at the Poultry Unit of the Department of Animal Science Teaching and Research Farm, Ebonyi State University Abakaliki. The experiment was conducted during hot dry season (November - December) which lasted for 84days. One hundred and twenty Shika brown layers were randomly divided into four treatment groups of 30 layers, each replicated three times with 10 layers per replicate, in a Completely Randomized Design (CRD). The groups were fed four diets containing 0 ml (only water), 200 mg/litre (vitamin C), 10 ml honey and 20 ml honey representing treatments 1, 2, 3, and 4, respectively for 84 days. A basal diet was served to the birds in all the treatments. The measurements taken include the heart and respiratory rate, 4 hourly rectal temperature, internal and external egg characteristics and blood samples. The proximate compositions of the diet were determined according to the methods of AOAC, (1990). The data collected was subjected to one-way analysis of variance (ANOVA) according to the method of Snedecor and Cochran (1978). Where significant differences were observed, means was separated using Ducan's New Multiple Range Test as outlined by Obi (2002).

RESULTS AND DISCUSSION

Table 1 shows the chemical composition of the basal diet used in the experiment. From the table it will be noted that the diet conform to the feed for laying birds.

Table 2 shows the meteorological data at the experimental site. The result from this study as represented in this table shows that the layers were subjected to high atmospheric temperatures and the value obtained were predominantly outside the established thermo neutral zone for chicken which is 22^{O}C-28 ^{O}C in the tropical region (Holik, 2009).

Table 3 shows the effect of honey and vitamin C on the heart rate, respiratory rate and rectal temperature of laying birds fed honey and vitamin C. The results shows that the heart rate differed significantly ($p<0.05$) among treatments. Layers on treatment 4 with 20ml of honey had lower heart rate compared to birds on treatment 1. Layers in treatment 1 (control) had the highest heart rate. Layers in treatment 4 had lower respiratory rate compared to those on other treatments. Addition of honey and vitamin C lowered the HR of laying birds. Laying birds offered 20/ml honey had the lowest HR followed by the group that received vitamin C. This report is in agreement with the report of Minka and Ayo (2010) and Ayo *et al.* (2007) that stress increases HR which is relevant on the spot diagnostic parameters of the state of an animal's health, before any laboratory analysis is carried out.

Table 4 shows the egg characteristics of layers fed honey and vitamin C. Results from the table shows that the mean values of egg weights were 53.3g, 57.3g, 59.6g and 60.3g, respectively for treatments 1, 2, 3, and 4, respectively. This indicates that layers offered ordinary water had reduced egg weight compared to those from treatments 2 and 4. This report is in agreement with the report of Wolfenson *et al.* (2001) who observed a reduction in egg profile of white leghorn layer egg exposed to stress. The egg length also increased in layer offered 20ml honey and this report is in agreement with Balnave and Muheereza (1997) who noted that the egg length increased in layers subjected to 4.7 days oxidative stress through administration and supplementation with 200mg of vitamin C/kg diet. The Haugh unit scores were significantly higher with layers offered honey compared to the control group. It should be noted that the Haugh unit values were within the range of freshly laid eggs (Essien, 1990).

Table 5 shows the hematological profile of layers fed honey and vitamin C. Layers on treatments 2 and 4 had the highest ($p<0.05$) PCV value of 28% and 29%. Birds offered ordinary water had the lowest PCV. This report is in agreement with the report of Altan *et al*. (2006) The red blood cell counts ($p<0.05$) differed significantly in laying birds offered ordinary water and had the lowest RBC compared to the laying birds offered 20 ml honey. This report is in line with the report of Mashaly *et al*. (2004) who reported that heat stress reduced the total red blood count in laying birds.

Table 6 shows the serum biochemistry of layers fed honey and vitamin C. The results indicates that feeding honey and vitamin C to layers significantly ($p<0.05$) influenced the total protein in all the treatments. Layers on treatment 4 had the lowest ($p<0.05$) value of 3.79g/dl compared to layers on other treatments. The total protein value of treatments 1, 2, and 3 were 4.83g/dl, 3.8g/dl, and 4.03g/dl respectively. The total protein value increased in birds offered ordinary water. This report is in line with the report of Rashidi *et al.* (2010) who noted that total protein increased in heat stressed broilers. The albumin differed significantly ($p<0.05$) among treatments. Layers on treatment 1 recorded high mean value of 1.94g/dl compared to other treatments. There was increase in the levels of Glucose, Calcium and Cholesterol level in birds without the additives compared to birds offered vitamin C and honey. The increase in glucose concentration is directly responsive to an increase in glucocorticoids hormone (Borges *et al.,* 2003).

CONCLUSION

It is therefore concluded that inclusion of honey at 20% level did not show any deleterious effect and could be used to elicit positive physiological responses of layers to stress conditions and improve their egg quality characteristics.

Table 1: The Chemical composition of basal diet used in the experiment

Feed sample	%CP	%CFat	%Cfibre	%Ash	%Moisture
Wet season feed	18.87	3.82	3.61	7.28	8.11
Dry season feed	17.15	3.79	3.57	7.33	8.06

Table 2: Meteorological Data Season 2 (Hot-Dry Season)

Hour	Maximum Temperature	Minimum Temperature	Inside pen	Relative humidity
08.00	35.2^{o}C	29.5^{O}C	32^{O}C	60
18.00	39.8^{O}C	32.6^{O}C	35^{O}C	54

Table 3: The effect of honey and vitamin C on the heart rate, respiratory rate and rectal temperature of laying birds fed honey and vitamin C

Parameter	T1(control)	T2 (vit C)	T3) 10ml honey)	T4 (20ml honey)	SEM
HR(bmp)	200.6[a]	110[b]	109[b]	106[b]	3.17
RR(bpm)	48[a]	45[a]	39[b]	37[b]	1.134
RT(^{o}C)	41.6[a]	40.5[a]	41.4[a]	39.8[a]	0.057

[a,b:] Means on the same row with different superscript are significantly (P< 0.05) different

SEM: Standard error of means.

HR Heart Rate

RR Respiratory Rate

RT Rectal Temperature

Table 4: Egg Characteristics of Layers Fed Honey and Vitamin C

	Treatment				
Parameter	T1(control)	T2 (vit C)	T3(10ml honey)	T4 (20ml honey)	SEM
Egg Weight (g)	53.66[a]	57.3[b]	59.6[b]	60.30[c]	0.3
Egg Length (cm)	5.30[a]	5.70[b]	5.90[b]	6.10[c]	0.05
Shell Thickness (mm)	0.30[a]	0.32[a]	0.31[a]	0.38[c]	0.03
Shell Weight (g)	4.40[a]	3.90[b]	5.60[b]	5.60[b]	0.03
Egg Width (mm)	4.66[a]	4.73[b]	4.50[ab]	4.73[b]	0.08
Albumen Weight(g)	35.0[a]	36.6[a]	38.3[b]	39.30[b]	0.5
Albumen Length (cm)	2.00[a]	3.10[b]	3.20[b]	3.40[c]	0.006
Albumen Height (mm)	5.20[a]	5.60[b]	5.80[b]	6.30[c]	0.12
Yolk Weight (g)	12.2[a]	13.10[b]	13.80[b]	14.43[c]	0.12
Yolk Height (mm)	1.50[a]	1.60[a]	1.70[a]	1.80[b]	0.05
Yolk Colour	10.0	10.0	10.0	10.0	0.33
Egg Shape Index	76.4[a]	77.6[a]	81.6[b]	82.1[b]	3.8
Feed Conversion Ratio	1.98[a]	1.80[b]	1.80[b]	1.70[c]	0.31
Haugh Unit	77.0[a]	78.3[a]	80.0[b]	80.0[b]	0.52

[a,b,c,d:] Means on the same row with different superscripts are significantly (p<0.05) different.

SEM: Standard error of the mean.

Table 5: Haematological indices of Layers fed Honey and Vitamin C

	Treatment				
Parameter	T1(control)	T2 (vit C)	T3(10ml honey)	T4(20ml honey	SEM
PCV (%)	22.33[a]	28[b]	27[c]	29[b]	0.03

RBC (/µl)	2.50×10^{6a}	2.70×10^{6b}	2.80×10^{6b}	3.00×10^{6c}	0.030
Heamoglogin (gl)	7.73^{a}	7.96^{b}	8.20^{b}	9.10^{c}	0.21
MCH (pg)	4.26^{a}	4.03^{b}	3.00^{b}	3.50^{c}	0.52
MCV (fl)	12.3^{a}	130^{b}	130^{b}	14.3^{c}	0.17
MCHC (g/l)	3.30^{a}	3.00^{b}	3.20^{ab}	3.10^{b}	0.20
WBC (/µl)	$3.90\times^{9a}$	$3.63\times^{9b}$	$3.5\times^{9b}$	$3.13\times^{9c}$	0.01
Heterophil (/µl)	30.0^{a}	30.75^{b}	30.6^{b}	31.43^{c}	0.05
Lyphocyte (/µl)	55.7^{a}	55.46^{b}	55.43^{b}	55.86^{b}	0.35
Basophils (/µl)	1.86^{a}	1.70^{b}	1.70^{b}	1.60^{b}	0.3
Eosinophily (/µl)	1.86^{a}	$1.8b^{a}$	1.73^{b}	1.66^{b}	0.05
Monocyte (/µl)	6.30^{a}	6.36^{a}	6.60^{b}	6.80^{b}	0.05
Heterophil:Lyphoctye	0.53	0.554	0.551	0.670	0.003

$^{a,b,c:}$ Means on the same row with different superscripts are significantly ($p<0.05$) different.

SEM: Standard error of the mean.

Table 6: The Serum Biochemistry of Layer Fed Honey and Vitamin C

Parameter	Treatment				
	T1(control)	T2 (Vit C)	T3(10ml honey)	T4 (20ml honey)	SEM
Total protein (g/dl)	4.83^{a}	3.8^{b}	4.03^{a}	3.79^{b}	0.059
Albumin (g/dl)	1.94^{a}	1.31^{b}	1.50^{b}	1.30^{b}	0.019
Globulin (g/dl)	2.89^{a}	2.49^{b}	2.53^{b}	2.49^{b}	0.029
Cholesterol (mmol/l)	184^{a}	158^{b}	159^{b}	148^{c}	0.577
Urea (mg/dl)	9.43^{a}	8.10^{b}	6.57^{c}	7.89^{d}	0.050
Creatinine (m/dl)	1.06^{a}	0.53^{b}	0.57^{b}	0.6^{b}	0.088
Calcium (m/dl)	6.70^{a}	8.01^{b}	11.4^{c}	11.08^{c}	0.11
Potassium (mmol/l)	3.68^{a}	6.10^{b}	6.24^{b}	6.50^{b}	0.037
Phosphorus (mmol/l)	6.19	6.13	6.15	6.13	0.066
Glucose (mg/dl)	245^{a}	218^{b}	222^{c}	212^{d}	4.04

[a,b,c d]: Means on the same row with different superscripts are significant ($p<0.05$) different.

SEM: Standard error of the mean.

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