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Physiological, Serum and Haematological Responses of Broiler Fed Honey at Varying Levels of Inclusion in the Diet

O. J. Osunkeye *
Department of Animal Science
Osun State University, P. M. B. 4494, Osogbo, Ejigbo Campus, Osun State, Nigeria

P.O. Fakolade
Department of Animal Science
Osun State University, P. M. B. 4494, Osogbo, Ejigbo Campus, Osun State, Nigeria

B.O. Alabi
Department of Animal Science
Osun State University, P. M. B. 4494, Osogbo, Ejigbo Campus, Osun State, Nigeria

V.O. Akinduro
Department of Animal Science
Osun State University, P. M. B. 4494, Osogbo, Ejigbo Campus, Osun State, Nigeria

B.E. Olorede
Department of Animal Science
Osun State University, P. M. B. 4494, Osogbo, Ejigbo Campus, Osun State, Nigeria

Abstract
This research was conducted at the Teaching and Research Farm of Osun State University, Osogbo, Osun State, Nigeria. It was design to examine the serum and haematological parameters responses of broilers fed with honey at varying levels of inclusion in the diet during hot season. One hundred and fifty six day old broiler chicks were purchased from hatchery. The birds were allotted into four treatments (T1, T2, T3, and T4 respectively) randomly and replicated in a completely randomized design. It was observed that there were no significant effect on the haematological parameters ($P>0.05$), though, the treatment has the capacity to increase the RBC and eosinophil. This study also showed that there was significant different between the T1 and the treatment at levels 10 ml, 20 ml and 30 ml of honey inclusion in the feed respectively. The average daily weight gains, average daily feed intake and feed conversion ratio of the broilers were significantly different among the treatments. This result indicated that the plasma protein produced by the liver which also added to the viscosity of blood was more in broiler fed with treated feed compared to that of the control. Therefore, this study indicated that honey can be used to maintain and regulate blood pressure in broiler because of the increase in the blood plasma protein (albumin) which exerts considerable osmotic pressure to maintain water balance between blood and tissues, and regulation of blood volume.
Keywords: Heat stress, albumin, feed intake, haematological parameters

1.0 INTRODUCTION

The requirement for the proper performance of rearing chickens is to ensure the optimum environmental conditions necessary for their proper development, growth, maintenance and running of production. These conditions must be suitable to the needs of the birds and they depend not only on age and number of maintained animals, but also on the season and weather conditions. During the hot summer months, it is difficult to exceed the recommended standards of microclimatic conditions, which usually becomes the cause of stress, causing disturbances in the homeostasis of the body's internal environment of birds (Abioja *et al.,* 2006). Chickens in the first two weeks of life are very susceptible to stress caused by environmental conditions the chick body temperature after hatching is 39.7^{o}C, and just at 3-weeks of age reaches 42^{o}C, which is equal to body temperature in adult birds. Therefore, it is widely accepted that the optimal air temperature for broiler chickens should be 31-33^{o}C at the first days of rearing and then be lowered to 2^{o}-18^{o}C. Birds are not able to dissipate heat for the body to the environment looses their ability to control body temperature. When the air temperature exceeds 38^{o}C there is observed increase in mortality of birds. The high sensitivity of birds to heat stress is caused by a small difference between the physiological body temperature and the temperature at which protein denaturized occurs and disruption of vital function. Heat stress causes slower growth and however body weight of Chickens, poor feed utilization, increases mortality cause by weakness of the body's immune function (Altan *et al.,* 2003).

This study showed the effect of honey as it was incorporated in the diet, on the growth and some

physiological responses of broilers reared during hot season. The aim is to use honey as anti-stress rather than using synthetic and commercially produced anti-oxidant such as vitamin C. Honey is a phyto-chemical and natural anti-oxidant which is more readily available compared to other anti-oxidant which are synthetic and may not be available especially to the rural and local farmers. The important of the knowledge derived from this present study lies in the reduction of stress posed by increased environmental temperature during hot season, which in turn decreases the cost of production and ultimately improve the growth of poultry industries in many developing countries such as Nigeria.

The objective of this study is to determine the physiological responses of the broilers fed with diet containing different levels of honey inclusion, as an indices to study the growth and adaptability of broiler chickens to heat stress and also to enhance the effectiveness of the use of natural anti-oxidant and anti-stress in place of inorganic unnatural sources of anti-stress commonly use during the period of dry season.

2.0 MATERIALS AND METHODS

One hundred and eighty unsexed broiler chicks of Anak strain were purchase from a reputable commercial hatchery at day-old. The birds were allotted into four dietary treatment groups with each treatment having three replicates of 15 birds per replicate in a completely randomizes design. The treatment were varying levels of honey incorporated into the diets, these include the Control (0 ml of honey/Kg Feed, T1), 10 ml of honey/Kg Feed (T2), 20 ml of honey/Kg Feed (T3), and 30 ml of honey/Kg Feed (T4). These birds were maintained and managed at the Poultry unit of Teaching and Research Farm of Osun State University, College of Agriculture, Ejigbo Campus, Osun State, Nigeria. They were fed with the diets formulated as the treatment. The experiment is made up of two phases; namely the starter phase (1 to 21 days) and finisher phase (22 to 42 days) (Table I). Throughout the experimental period, feed and water were given *ad libitum*.

2.1 Analysis of growth performance

The liveweight of the birds in each replicate were recorded on weekly basis. The body weight gain was determined from the record of the weekly liveweight. Feed intake was determined from the weight of the feed given, and left over. The feed intake, body weight gain, and feed conversion ratio were calculated.

2.2 Analysis of haematological and serum responses

At the last day of the experiment, 2 ml of blood samples were collected from three birds picked at random from each replicate through the large vein under the wing (Bronchial vein) into Ethylene Diamine Tetraacetic Acid (EDTA) ant-coagulant bottle and mixed gently for the haematological analysis, and 5 mls of blood samples were collected into non-anticoagulant bottle for serum analysis. Haematological parameters and serum chemistry were determined using the methods highlighted by A.O.A.C (2005). The haematological parameters include white blood cell (WBC), Red blood cell (RBC), Packed cell volume (PCV), Haemoglobin (Hb), Lymphocyte, Heterophil, Eosinophil, Basophil and Monocyte; while the serum chemistry includes Total protein, Albumin, Creatinine, Alt and Cholesterol.

2.3 Statistical analysis

All data collected were subjected to one-way analysis of variance using Systat Statistiacal Package version 2.05 (1992). Values were expressed as the mean ($\pm$SEM). Significant means were separated using Duncan post-hoc test ($P<0.05$).

The model is:

$\gamma ij = \mu + Ti + \varepsilon ij$

where γij = Dependent variables, μ = ith effect due to treatment, i= 1,2,3,4, and εij = residual error

3.0 Result and discussion

The average daily weight gain of the birds was significantly different ($P<0.05$). The highest daily weight gain was recorded in T2 compared with T3 and T4 (33.41 g and 33.33 g respectively). The analysis revealed no differences between T1 and T2, however, the value of daily weight gain of the broilers in T2 seems to be greater than T1. Average daily feed intake showed that the birds in T4 were consuming 119.49 g of feed on daily bases, which is more than every other treatment. But T1 showed an appreciable feed intake of 112.39 g/day with highest average weight gain of 33.96 g/day. No mortality was recorded in treatment T2 and T3. It is clearly shown that treatment T2 (that is, broilers fed with 10 ml/kg Feed) performed best in terms of growth despite reduced daily feed intake.

Table IV shows the effect of honey inclusion at varying levels in the diet of broilers on the serum parameters. Statistically, it was revealed that there were no significant differences in all the parameters measured except that of serum albumin ($P< 0.05$).This result agrees with Obun (2011) who reported that serum albumin of

broilers improved with increasing dietary honey inclusion. It shows that there was more serum albumin compared to that of the control. There was increasing serum albumin with decreasing honey inclusion. That is the highest serum albumin was recorded in treatment T2 (10 ml honey inclusion), then treatment T3, and T4 at 1.80±0.20, 1.73±0.11 and 1.67±0.50 respectively. The results indicated that the plasma proteins produced by the liver which also added to the viscosity of blood was more in broilers fed with honey inclusion diets compared to the control. Therefore, it implies that honey can be used to maintain and regulate blood pressure in broilers because increase in blood plasma protein (albumin) exerts considerable osmotic pressure to maintain water balance between blood and tissues, and regulation of blood volume. There were no significant difference in all the haematological parameters ($P>0.05$).

Figure 1 showed that the effect of honey inclusion at varying levels in the feed of broilers on the rectal temperature reveals that the rectal temperature was high at week 1 and 2, but between week 2 and week 3 there was a decrease and then at week 3 and 4,there was an increase. However, the rectal temperature reduced between week 4 and 5 and increased at between week 5and 6, at week 7 a sharp reduction in the rectal temperature was observed.

This result further reveals that as the birds increases in age, there was a constant increase in the rectal temperature and a thermoregulation that brought about the increase and reduction in a rhythmic manner was taking place and that honey inclusion in diet at varying levels was effective in reducing heat stress because of what was observed in week 7, when the age of birds increased and the rectal temperature reduced. This result agrees with the result of Deeb and Cahaner (1999) which reported that the rectal temperature is the most important physiological responses that reflect the thermoregulation of animal body and has been suggested to be an indicator of heat stress in broilers. Abioja *et al.,* (2009) also reported tha honey is a natural antioxidant and that when offered at varying levels in the drinking water could control heat stress.

Furthermore Figure 1 also showed that the water intake increased as the week increased, and between week 3 and week 4, there was a reduction in the water intake but it continued to increase as the week was increasing, between week 4,5 and week6, however, at week 7, water intake started to reduce, this indicated that there is a relationship between reduction in rectal temperature and reduction in water intake, this report agrees with the report of Lacy *et al., (*2002), which states that water and food consumption rates are interdependent, so reduced water intake can also lead to reduced feed intake and there are other factors that affect water intake, with temperature being the most obvious one. This report also agrees with the findings of Anthony (2005), which states that water intake increases with age, a lack of water can seriously retard growth and this is particularly true in tropical countries where deprivation can lead to death of poultry within a short period of time.

Conclusion

From this study, it can be concluded that honey inclusion in the feed fed to broiler at finisher stage does not have any significant effects on the haematological parameters; however, the serum indicated that its effect was on the albumin content of the blood. In addition, honey can cause a significant effect on the blood pressure because of the feed effect on the albumin, and there were no negative effects of honey inclusion on the blood parameters.

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Table 1: Gross composition of broiler starter and finisher diet

INGREDIENTS	STARTER PHASE				FINISHER PHASE			
	T1	T2	T3	T4	T1	T2	T3	T4
MAIZE	52.00	52.00	52.00	52.00	60.00	60.00	60.00	60.00
SOYABEAN	33.00	33.00	33.00	33.00	22.00	22.00	22.00	22.00
WHEAT OFFAL	8.00	8.00	8.00	8.00	12.60	12.60	12.60	12.60
FISH MEAL(72%)	3.00	3.00	3.00	3.00	1.50	1.50	1.50	1.50
LIMESTONE	2.40	2.40	2.40	2.40	1.50	1.50	1.50	1.50
BONE MEAL	0.80	0.80	0.80	0.80	1.80	1.80	1.80	1.80
SALT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
METHIONINE	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
LYSINE	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
BROILER STARTER PREMIX	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
HONEY (per KG FEED)	0	10	20	30	0	10	20	30
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated value crude protein(%)	22.29	22.29	22.29	22.29	17.93	17.93	17.93	17.93
Metabolizable energy(kcal/kg)	2756.32	2756.32	2756.32	2756.32	2793.09	2793.09	2793.09	2793.09
Calcium	0.18	0.18	0.18	0.18	0.12	0.12	0.12	0.12
Phosphorus	0.50	0.50	0.50	0.50	0.49	0.49	0.49	0.49

Premix provides the following per kg of feed: Vit A-500IU, Vit D3-1250mg,VitE-11mg, Vit K-2mg, Riboflavin-25mg, Nicotine acid-15mg, Pantothenic acid-7mg, Cobalamin-0.08mg,Choline chloride-900mg, Folic acid-1.5mg, Iron -2.5mg, Manganese-80mg, Copper-2mg, Zinc-50mg, Cobalt-1.25mg and Selenium-0.1mg

Table 2: Proximate composition of experimental diets at starter and finisher phase

Constituents	STARTER PHASE				FINISHER PHASE			
	T1	T2	T3	T4	T1	T2	T3	T4
Dry matter (%)	88.02	90.01	87.21	90.76	89.21	91.30	91.86	90.55
Crude protein (%)	22.78	23.09	23.63	24.13	19.63	19.84	20.05	20.33
Crude fibre (%)	3.90	4.20	4.30	4.00	4.10	3.70	3.80	4.00
Ash (%)	6.00	5.00	6.00	7.00	7.00	7.00	6.00	7.00
Ether extract (%)	9.00	10.00	10.00	9.00	10.00	12.00	11.00	10.00
Nitrogen free extract (%)	58.32	57.71	56.07	55.87	59.27	57.46	59.10	57.67

Table 3: Effect of varying levels honey inclusion in diets on the performance characteristics of broiler

Treat	T1 (0 ml/kg feed)	T2 (10 ml/kg feed)	T3 (20 ml/kg feed)	T4 (30 ml/kg feed)	SEM
Ave. Initial liveweight (g)	14.47	14.47	14.46	14.47	0.05
Ave. final liveweight (g)	1886.36^{b}	1916.67^{a}	1885.25^{b}	1825.00^{c}	0.24
Ave. final weight gain (g)	1871.89^{b}	1902.20^{a}	1870.79^{b}	1810.53^{c}	0.25
Ave. daily weight gain (g)	33.43^{a}	33.96^{a}	33.41^{b}	33.33^{b}	0.25
Ave. Ave. weekly weight gain	233.92^{b}	237.77^{a}	233.85^{c}	226.32^{c}	0.25
Ave. daily feed intake	110.64^{d}	112.39^{c}	114.89^{b}	119.49^{a}	0.82
Feed conversion ratio	3.68^{b}	3.67^{b}	4.09^{a}	4.12^{a}	0.21
Mortality %	2.56^{b}	0.00^{c}	0.00^{c}	7.56^{a}	0.08

a, b, c : mean on the same row are significantly different (P<0.05)

Table 4. Serum parameters of broilers fed honey inclusion in the diet at varying levels

TREATMENT	TP(g/dl)	ALB(g/dl)	CRT (mg/dl)	ALT(I.U/L)	CHOL(mg/dl)
O ml	2.26±0.28	1.23±0.19^{b}	0.95±0.18	10.29±1.13	64.77±1.69
10 ml	2.70±0.18	1.80±0.20^{a}	0.78±0.31	12.43±1.83	100.76±1.54
20 ml	2.55±0.13	1.73±0.11^{a}	0.73±0.24	9.10±1.11	106.00±1.27
30 ml	2.38±0.13	1.67±0.50^{a}	0.56±0.08	9.58±0.71	93.36±1.72

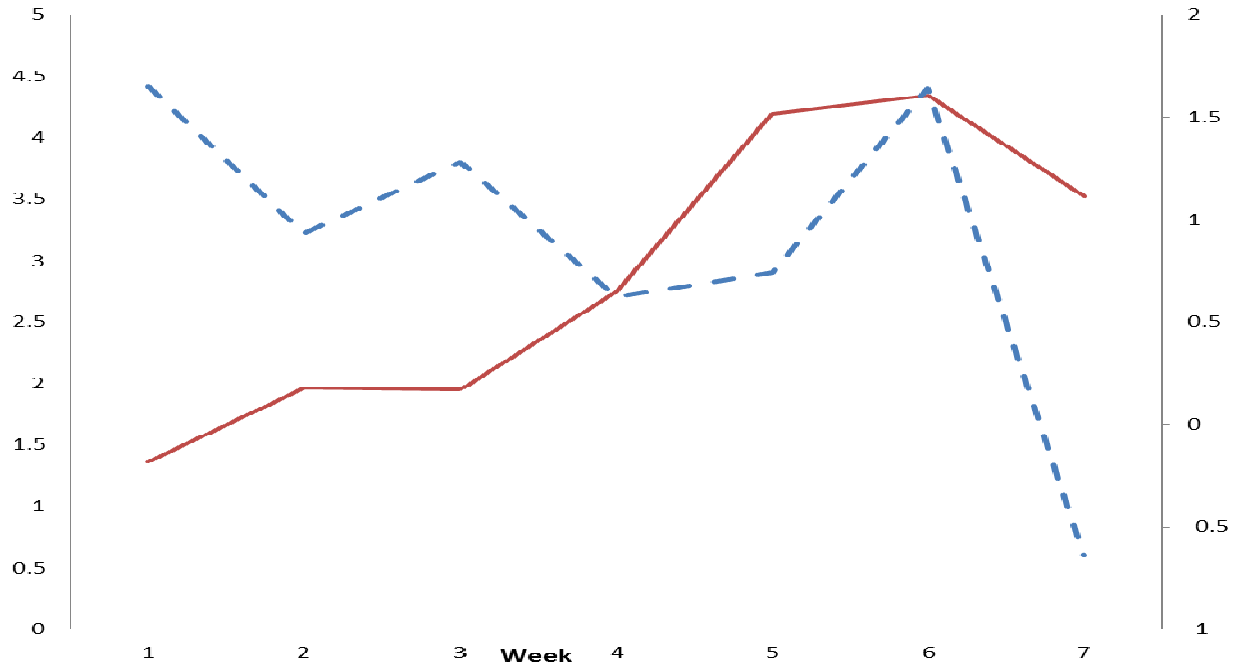

Figure 1: Water intake and changes in the rectal temperature of broilers fed with honey inclusion in diet across the week

Key

■ - - - - - - - - - - - - - - Changes in rectal temperature

■ _____ Water intake