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Research Article

Effects of a Combination of Honey and Vitamin C on the Blood Parameters of Broiler Chicks

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Abstract

Poultry production is a good way of boosting the growth of the national economy. This study was conducted to determine the impact of vitamin C and honey on a few blood parameters of broiler chickens. A total of sixty-four-week-old broiler chickens were used in this study. Four experimental diet treatments were given to the chickens. Treatment 1 were given to broilers in cage A that contained no honey and no vitamin C in their drinking water. Treatment 2 was given to broilers in cage B which contained only 5 ml of honey. Treatment 3 was given to broilers in cage C which contained only 100 mg of vitamin C. Treatment 4 was given to broilers in cage D which contained 5 ml of honey and 100 mg of vitamin C. The experiment lasted for 10 weeks during which the following parameters were monitored; PCV and plasma protein. Analysis of variance was performed on the gathered data at a 5% significance level. The result of this study revealed that the highest PCV increase was recorded in the broiler chicks in Treatment 4 (27.40%) while the least was recorded in Treatment 1 (23.80%). After ten weeks, the PCV rise of broiler chicks receiving the four treatments did not differ significantly ($P>0.05$). The highest total protein was recorded in the broiler chicks in Treatment 3 (3.70 g/dl) while the least total protein (2.20 g/dl) was recorded in Treatment 4. The total protein of broiler chicks that received the four treatments for ten weeks varied significantly ($P<0.05$). The highest albumin was recorded in the broiler chicks in Treatment 2 (2.23 g/dl) while the least albumin (1.20 g/dl) was recorded in Treatments 1 and 4. There was significant difference between the albumin of broiler chicks given T3 and other treatments ($P<0.05$) except T2 ($P>0.05$) for 10 weeks. The highest globulin was recorded in the broiler chicks in Treatment 3 (1.67 g/dl) while the least globulin (1.10 g/dl) was recorded in Treatment 2 and 4. There was significant difference between the globulin of broiler chicks given T3 and other treatments ($P<0.05$) for 10 weeks. It was determined that combining honey and vitamin C is preferable than utilizing them separately as well as the control water.

Keywords

Broiler Chicken, Honey, Vitamin C, Blood Parameters

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1. Introduction

Malnutrition is the major challenge in Africa especially in Nigeria as most of the diets are deficient in animal protein [20]. The problem of protein malnutrition is real among human populations particularly in developing countries. Hence the need to sought avenues to ameliorate the problem. Poultry production is one of such ways and has significantly boosted the growth of the national economy [21]. Broiler chicken production also plays a vital role in food security for the fast increasing human population in Nigeria due to the short production cycle, high feed efficiency and growth rate of the birds. During the growing-finishing phase in the tropics, the birds are however faced with the challenges of managing with the ever-changing elements of weather, especially the ambient temperature [17].

Poultry production is one of the surest and fastest ways of bridging the animal protein in-take gap in developing countries of the world [15, 22]. The high nutritive value, short cycle and relative cheap cost of production make poultry products the ideal animal protein source for feeding the world's human population [11, 17]. Poultry production has been constrained by inadequate feed supply and high cost of conventional protein and energy sources [2]. Genetic improvement of growth performance traits of broilers has led to higher production efficiency index; however, the birds are more susceptible to diseases due to immune system weakness [9].

The current trend in livestock production is embracing organic agriculture which involves the use of natural materials such as honey and vitamin C [23]. Honey is one of the energy sources for poultry birds rich in essential nutrients such as sugars, proteins, vitamins and minerals [19]. Honey is made by honeybee and it includes about 180 types of different substances such as water, proteins, sugars, vitamins, minerals and various biologically active ingredients such as flavonoids, polyphenols, aromatic substances and diterpene. Honey has different characteristics such as anti-oxidative, anti-inflammatory, anti-microbial, anti-viral, anti-fungal, anti-cancer, anti-diabetic properties [8].

Vitamin C is a water-soluble vitamin with anti-stress, anti-oxidant and immune enhancement [6]. Vitamin C also plays a major role in the biosynthesis of corticosterone [3]. Thus, the aim of this study was to evaluate the effect of combination of honey and vitamin C on growth performance and some blood parameters of broiler chicks.

2. Materials and Methods

2.1. Site for the Experiment

The Animal House in the Department of Animal Science at Nnamdi Azikiwe University in Awka, Anambra State, Nigeria, served as the studies location. Located in the state's humid tropical climate, Nnamdi Azikiwe University is the only federal university in Anambra State. Anambra State's capital, Awka, has a population of around 301,657 according to the 2006 Nigeria census. In Southeastern Nigeria, Awka is located at latitude 06 °12ˡ 25ˡN and longitude 07 °04ˡ and 300 easts [13].

2.2. Procurement of Experimental Animals

In this study, 64-week-old broiler chickens were utilized. They came from OJB farm in Awka, Anambra State, and transported to the study site in a perforated carton to aid aeration.

2.3. Management of Experimental Animals

The birds were intensively managed in an improvised metabolic cage of four-tier cage structure. Each cage of length 2 m, breadth 2 m and height 2 m, were used to house five birds. The cage sides were covered with wire gauze to allow ventilation and the floors were made from wood to enable sweeping out of droppings. During this experiment, the birds were subjected to similar managerial and sanitary conditions, so that the only source of variation is the drinking water treatment. The chicks were given coccidiostat on arrival for two days and allowed to acclimatize for 7 days after which they were given Lasota vaccine.

2.4. Experimental Design

The birds were fed with conventional livestock feed for seven days, so as to acclimatize to the new environment before they were given experimental treatment. The experimental design comprises 4 treatments with 3 replicates each and 5 birds per replicate. The completely randomized block design was used for this study.

2.5. Source of Treatments

The commercial feed (top feed) used for this study was obtained from Eke market, Awka, Anambra State. The honey used was purchased from the Honeybee Research Center of the Department of Zoology while the vitamin C was purchased from Gauze Pharmacy in Nnamdi Azikiwe University, Awka Anambra State.

2.6. Experimental Treatments

The broilers were given similar broiler starter and finisher feed (Table 1) but with variation in the quantity of honey and Vitamin C dissolved in their drinking water. The Treatment 1 assigned to broilers in cage A contained no honey and no vitamin C in their drinking water. Treatment 2 was assigned to broilers in cage B which contained only 5 ml of honey. Treatment 3 was assigned to broilers in cage C which contained only 100 mg of vitamin C. Treatment 4 was assigned to broilers in cage D which contained 5 ml of honey and 100 mg of vitamin C. Each treatment was replicated three times.

Table 1. Nutrient Composition of Experimental Basal Diet (25 kg).

Composition	Starter	Finisher
Energy (kcal/kg)	2900	3100
Crude protein (%)	21.00	18.00
Fat/oil (%)	6.00	15.00
Crude fibre (%)	5.00	10.50
Calcium (%)	1.00	0.75
Phosphorus (%)	0.45	0.45
Lysine (%)	1.00	1.00
Methionine (%)	0.50	0.50
Salt (%)	0.30	0.30

2.7. Hematological Analysis

2.7.1. Determination of the Packed Cell Volume

The packed cell volume (PCV) was determined using the microhematocrit method [10]. The initial PCV was taken after acclimation and subsequently at two weeks interval. Blood was collected into a heparinized capillary tube by puncturing the wing vein. The tube was 2/3 filled with the blood sample and sealed at one end with sealant. The microhematocrit centrifuge was used to spin the blood sample at 10,000 revolutions per minute for 5 minutes. After centrifuging, the PCV of each blood sample was read using a microhematocrit reader expressed in percentage.

2.7.2. Blood Collection for Plasma Protein Analysis

At the end of the experiment that is after 10 weeks, three chicks were randomly selected from each treatment, making a total of 12 birds. From each selected bird, 1.5 ml of blood was collected into ethylenediaminetetraacetic acid (EDTA) bottles by puncturing the brachial wing vein. The bottles were immediately capped and preserved in a bowl of ice blocks. Later the blood was refrigerated at 4°C for about three hours and allowed to defrost before the analysis properly. They were taken to Glanson Laboratory, Awka, Anambra State for plasma protein analysis. The samples were used to determine the following parameters; total plasma protein, albumin and globulin levels using procedure by [7].

a). Assay of Total Plasma Protein (TPP)

The total plasma protein was determined by the Biuret colorimetric method [7] to obtain concentrations (g/l) per blood sample.

Procedures: three tubes were set up which included test, standard and control. Twenty-five microliter (25 µl) of samples were added to each tube set up.

N.B: the working reagent = 1 in 4 dilution biuret reagents, i.e. 1 ml of biuret reagent in 4 ml of biuret diluents.

Two milliliters (2 ml) of the working reagent were added to each of the tubes set up, it was then mixed and incubated for 30 minutes at 37°C and, then zeroed with blank (blank = the reagent without sample in it). Then the test, standard and control were read at 450 nm to get optical density using spectrophotometer.

$$Total\ Protein\ Concentration = \frac{O.D\ test}{O.D\ Standard} x \frac{Conc\ std}{1}$$

b). Assay of plasma albumin and globulin

Bromocresol green Colorimetric method was used (Chow, 1947).

Procedure: Three tubes were set up: test, standard and control. Then 10 µl of the sample was added to each of the tubes.

N.B: Hundred milliliters (100 ml) of the working reagent was prepared by adding thirteen milliliters (13 ml) of bromocresol green (which is optimum amount of the vial) to eighty-seven milliliters (87 ml) of deionized water to make up 100 ml of the working reagent.

Three milliliters (3 ml) of the working reagent were added to each of the tubes set up containing the sample and incubated for 5 minutes at 37°C. It was then zeroed with reagent blank and read at 630 nm to get the optical density of the test, standard and control.

$$Albumin\ (g/dl) = \frac{O.D\ test}{O.D\ Standard(Std)} x \frac{Concentration\ of\ standard}{1}$$

The globulin concentration was obtained by subtracting albumin concentration from total protein values

i.e. TPP- Albumin = Globulin

2.8. Statistical Analysis

The data collected on blood parameters during the experiment was subjected to Analysis of Variance (ANOVA) (Steel and Torrie, 1980), using SPSS computer package (version 21) at 0.05 significance levels. The comparison of means was partitioned using Least Significant Difference (LSD) test [12].

3. Results

3.1. Packed Cell Volume (PCV)

The result of the PCV increase in broiler chicks given honey and vitamin C for 10 weeks is presented in Table 2. The highest PCV value was recorded in the broiler chicks in Treatment 4 (27.40±14.807%) followed by those in Treatment 2 (25.13±10.169%) and Treatment 3 (24.47±11.704 %), while the least PCV increase was recorded in Treatment 1 (23.80±12.161%). The analysis of variance revealed that there was no significant difference ($p>0.05$) between the PCV increase of broiler chicks in the four treatments after 10 weeks.

Table 2. PCV of broiler chicks subjected to different levels of honey and vitamin C.

Parameters	T1	T2	T3	T4
Initial mean PCV	16.53±9.265[a]	21.87±10.803[a]	19.47±10.710[a]	22.93±12.244[a]
Final mean PCV	40.33±11.255[a]	47.00±11.097[ab]	43.93±7.601[ab]	50.33±8.829[b]
Mean PCV Gain	23.80±12.161[a]	25.13±10.169[a]	24.47±11.704[a]	27.40±14.807[a]

*Rows with similar superscripts are not significantly different from each other p>0.05
T1= control; T2= 5 ml of honey in water; T3= 100 mg of vitamin C in water; T4= 5 ml of honey and 100 mg of vitamin C in water.

3.2. Blood Plasma Protein

The result of the blood plasma protein of broiler chicks given honey and vitamin C for 10 weeks is presented in Table 3. The table revealed that the highest total protein was recorded in the broiler chicks in Treatment 3 (3.70±0.200 g/dl) followed by those in Treatment 2 (3.40±0.200 g/dl) and Treatment 1 (2.37±0.153 g/dl), while the least total protein (2.20±0.200 g/dl) was recorded in Treatment 4. The analysis of variance results revealed that there was significant difference ($p<0.05$) between the total protein of broiler chicks in the four treatments for the 10 weeks.

3.2.1. Albumin

Also, as shown in Table 3, the highest albumin was recorded in the broiler chicks in Treatment 2 (2.23±0.153 g/dl) followed by those in Treatment 3 (2.10±0.100 g/dl), while the least albumin (1.20±0.100 g/dl) was recorded in Treatments 1 and 4. The analysis of variance revealed that there was no significant difference ($P>0.05$) between the albumin of broiler chicks given T1 and T4. However, there was significant difference ($p<0.05$) between the albumin of broiler chicks given T3 and other treatments except T2 for the 10 weeks.

3.2.2. Globulin

The result in Table 3 revealed that the highest globulin was recorded in the broiler chicks in Treatment 3 (1.67±0.153 g/dl) followed by those in Treatment 1 (1.17±0.153 g/dl), while the least globulin (1.10 g/dl) was recorded in Treatment 2 and 4. The analysis of variance revealed that there was significant difference ($P<0.05$) between the globulin of broiler chicks in T3 and other treatments for the 10 weeks.

Table 3. Blood Plasma Protein of broiler chicks subjected to different levels of honey and vitamin C.

Treatments	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)
T1	2.37±0.153[a]	1.20±0.100[a]	1.17±0.153[a]
T2	3.40±0.200[b]	2.23±0.153[b]	1.10±0.100[a]
T3	3.70±0.200[b]	2.10±0.100[b]	1.67±0.153[b]
T4	2.20±0.200[a]	1.20±0.100[a]	1.10±0.100[a]

*Columns with similar superscripts are not significantly different from each other P>0.05
T1= control; T2= 5 ml of honey in water; T3= 100 mg of vitamin C in water; T4= 5 ml of honey and 100 mg of vitamin C in water.

4. Discussion

The result of this study showed that the highest PCV increase was recorded in the broiler chicks in Treatment 4 (27.40%) followed by those in Treatment 2 (25.13%), while the least PCV increase was recorded in the Treatment 1 (23.80%). The PCV values recorded in the broilers given honey and vitamin C are within the normal range for chick's PCV (24.9–45.2 %) as reported by [16]. However, the addition of honey and vitamin C did not significantly affect the PCV. This was in line with the observation by [4] who stated that giving heat stressed broilers vitamins in drinking water had no effect on PCV. Contrastingly, [18] reported that the PCV of laying birds were significantly influenced by honey and vitamin C fed to layers in drinking water. The result of this study also revealed that the birds in the control group had the least PCV increase. Similar report was given by

Altan *et al*. (2000) who reported that birds offered ordinary water had the least PCV. This may be attributed to the nutritional composition of the treatments. [14] reported that PCV was very sensitive to the level of protein intake by poultry.

The blood plasma parameters (total protein, albumin and globulin) of broilers were significantly affected by honey and vitamin C in their drinking water. This was in contrast with the findings of [4] who observed that the addition of 1 g of vitamin C per 1 litre of drinking water had no effect on blood total protein, albumin and globulin of broiler birds. The reason for the difference in results could be attributed to the variation in the quantity of honey and vitamin C. The values of the blood serum parameters observed by [18] were different from that observed in this study. They reported significant differences with respect to total proteins (3.79 g/dl), albumin (1.30 g/dl), globulin (2.49 g/dl), in favour of the birds in treatment administered with honey and the control. This difference in blood serum parameters could be attributed to the variation in the quantity of honey used. Contrastingly, natural vitamin C has no major impact on cumulative performance or plasma mineral status [1].

5. Conclusion

This study on the effect of honey and vitamin C on the blood parameters of broilers has revealed that the blood parameters (PCV increase, total protein, albumin and globulin) of broilers were significantly affected by the addition of honey and vitamin C to their drinking water. The result of this study showed that it is better to use a combination of honey and vitamin C than using honey and vitamin C separately and the control water. There is need for the addition of 5 ml of honey and 100 mg of vitamin C in the drinking water of broilers by poultry farmers since it significantly affected the hematology indices of broilers.

Abbreviations

PCV	Packed Cell Volume
EDTA	Ethylenediaminetetraacetic Acid

Conflicts of Interest

The authors declare no conflicts of interest.

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