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Effect of Honey and Vitamin C on the Growth Performance of Broiler Chickens

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Most African countries experience the challenge of food shortage, primarily protein from animal origin. The current research was conducted to examine the effect of honey and vitamin C on the growth performance of broiler chickens. This study employed sixty broiler chickens that were four weeks old which were assigned to four dietary treatments.Treatment 1 was assigned to broilers in cage A which contained no honey and no vitamin C (Control) in their drinking water. Treatment 2 was assigned to broilers in cage B which contained only 5 ml of honey (H). Treatment 3 was assigned to broilers in cage C which contained only 100 mg of vitamin C (C). Treatment 4 was assigned to broilers in cage D which contained 5 ml of honey and 100 mg of vitamin C (HC). This study lasted for 10 weeks and the following parameters were monitored: weight gain and feed intake. The data collected were subjected to analysis of variance at 5% significant level. The result of this study revealed that the highest feed intake (P<0.05) was recorded in the broilers on

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Treatment 4 (4182.67 g) followed by those in Treatment 3 (4044.33 g), while the least feed intake was recorded in Treatment 1 (2096.67 g). Broilers on Treatment 4 gained the most weight (2013.333g), whereas those on Treatment 1 gained the least (1422.00g). The broilers in Treatment 4 had the highest specific growth rate (10.84g%/day), whereas Treatment 1 had the lowest (10.33g%/day). The highest feed conversion ratio was recorded in the broilers on Treatment 1 (1.49) while the least was recorded in Treatment 3 (2.50). There was significant difference (P<0.05) among the feed conversion ratio of broiler chicks given the four treatments after 10 weeks. It was concluded that it is better to use a combination of 5 ml honey and 100 mg vitamin C than using honey and vitamin C separately to improve the growth performance of broiler chickens.

Keywords: Honey; vitamin c; growth performance; broiler chicken.

1. INTRODUCTION

Most African countries are faced with the problem of food shortage especially protein from animal origin [1]. This has made malnutrition a significant problem in Africa especially in Nigeria because majority of the diets lack adequate animal protein [2]. The problem of protein malnutrition is real among human populations particularly in developing countries, hence the need to seek avenues to ameliorate the problem. Poultry production is one of such ways and has significantly boosted the growth of the Nigerian economy [3]. Poultry includes a variety of domesticated bird species, including game birds, ducks and other water fowls as well as chickens raised for their eggs (layers) or meat (broilers). Every species produces in a distinctively different way [4].

One of the most reliable and efficient strategies to close the gap in animal consumption for underdeveloped nations is through poultry farming [5,6]. Poultry products are among the best animal protein sources for feeding the world's population because of their high nutritional content, short production cycle and reasonably low cost of production [7,8]. Animal protein demand and supply gap among Nigerians has continued to widen, resulting in sub-optimal animal protein intake and consequently predisposing the people to animal protein malnutrition [9]. It offers a viable way of recovering money fast and making extra income [5]. It is pertinent to note that about 10% of Nigerian population is engaged in poultry production making broiler production a rapid growing agricultural business [10]. According to Folorunsho and Onibi [11], eggs and poultry meats have a great deal of potential to satisfy people's dietary needs for animal protein in Nigeria. They provide people with lean protein sources especially those with heart and cholesterol problems [12].

Previous research showed that a vital component of monogastric output is feed [13,14]. The scarcity of feed and the high cost of traditional protein and energy sources have limited poultry production [14]. One of the energy sources for chickens that is high in vital elements including carbohydrates, vitamins and minerals is honey [15]. Honey is not only used for its nutritional benefits but also for its therapeutic effects in animals including broilers [16]. Corticosterone production is another important process that is greatly aided by vitamin C [17]. It is an important glucocorticoid hormone that promotes gluconeogenesis to increase energy availability under stress [18]. One of the effective ways to mitigate the harmful effects of heat stress in broiler chickens is to give them vitamin C [19].

Temperature strain is one of the significant factors that could have an impact on the health of the poultry birds [20]. Poultry birds becomes stressed by high ambient temperature, accompanied by high relative humidity [21]. To reduce stress, farmers employ a variety of techniques. Such methods include: using low energy and high protein diets, adding vitamin C, honey, sodium bicarbonate, potassium chloride or aspirin in drinking water of birds, use of electric fans and pad cooling system, misting of water through foggers and use of ice buckets [21].

Natural antioxidants can be found in honey, which makes it a complex substance. Antioxidants are important because they lower free radicals and stop lipid peroxidation which shield cells from reactive oxygen species (ROS) [22,8]. When compared to the conventional synthetic vitamin C, honey is more widely available, particularly for farmers in the rural areas. An excellent example of a naturally occurring item that contains phytochemicals is honey. It also contains enzymes, glucose oxidase, catalase, pantothenic acid, thiamine,

riboflavin, pyridoxine and peroxidase [8]. Although research has been done on the utilization of vitamin C and honey, there is still a dearth of knowledge regarding the use of vitamin C and honey in Awka, Anambra State, for raising broilers and preventing extreme heat exhaustion. The aim of this research was to evaluate the effects of combining vitamin C and honey on the growth development of poultry raised on broilers.

2. MATERIALS AND METHODS

2.1 Experimental Site

This research was carried out in the Animal House of the Department of Animal Science, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. Nnamdi Azikiwe University is the only Federal University in Anambra State. Anambra State falls within the humid tropics. "Awka is the capital of Anambra State with an estimated population of 301,657 inhabitants as of 2006 Nigeria census. Awka lies in the south eastern Nigeria at latitude 06°12ˡ 25ˡN and longitude 07° 04ˡ and 300 east" [23].

2.2 Procurement of Experimental Animals

A total of sixty 4-week-old broiler chicks used in this study were obtained 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 four-tier metabolic cage. 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 study, the birds were kept under similar managerial and hygienic circumstances, therefore the only source of change was the drinking water treatment. The chicks were given coccidostat on arrival for two days and was 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 the experimental diets. The experimental design comprised four treatments with three replicates each and five 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. Nigeria. The honey used was purchased from the Honeybee Research Center of the Department of Zoology while the vitamin C was purchased from Gauze Pharmacy both in Nnamdi Azikiwe University, Awka Anambra State, Nigeria

2.6 Experimental Treatments

The broilers were given similar broiler starter and finisher feed (Table 1) but with variation in the quantities 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

Source: Top feed®

2.7 Determination of Growth Performance

The birds' weights were collected weekly with a sensitive weighing balance (CAMRY model EK5055). From the weight of the birds, other parameters were calculated thus:

i. Feed intake = Weight of Feed fed (g) – Weight of feed left over (g) [8]

$$\text{Mean feed intake} = \frac{\text{Total feed intake}}{\text{Number of days of experiment}}$$

ii. Weight gain = Final weight (g) - Initial weight (g) [8]

iii. Specific growth rate (SGR): This was determined using data on changes in body weight throughout the provided time interval as adopted as adopted by Oke *et al*. [8];

$$\text{SGR} = \frac{\text{Log}e\text{W}_2 - \text{LogeW}_1}{\text{T}_2 - \text{T}_1} X\ 100$$

Where W_2 = Final weight of broilers at time T_2

W_1 = Initial weight of broilers at time T_1

e = Base of natural logarithm.

iv. Feed Conversion Ratio (FCR): this was calculated using the formula adopted by Oke *et al*. [8]:

$$\text{Feed Conversion Ratio} = \frac{\text{Mean Weight Gain}}{\text{Mean Feed Intake}}$$

2.8 Statistical Analysis

The data obtained on feed intake and growth of broilers during the experiment was subjected to One-Way Analysis of Variance (ANOVA) [24], using SPSS computer package (version 21) at 0.05 significance level. The comparison of means was partitioned using Least Significant Difference (LSD) test [25].

3. RESULTS

3.1 Feed Intake

The result of the feed intake of broilers given honey and vitamin C after 10 weeks is presented in Fig. 1. The highest feed intake was recorded in the broiler chicks on Treatment 4 (4182.67±3.06g) followed by those in Treatment 3 (4044.33±2.52g), Treatment 2 (3142.00±2.00g) while the least feed intake was recorded in Treatment 1 (2096.67±2.52g).

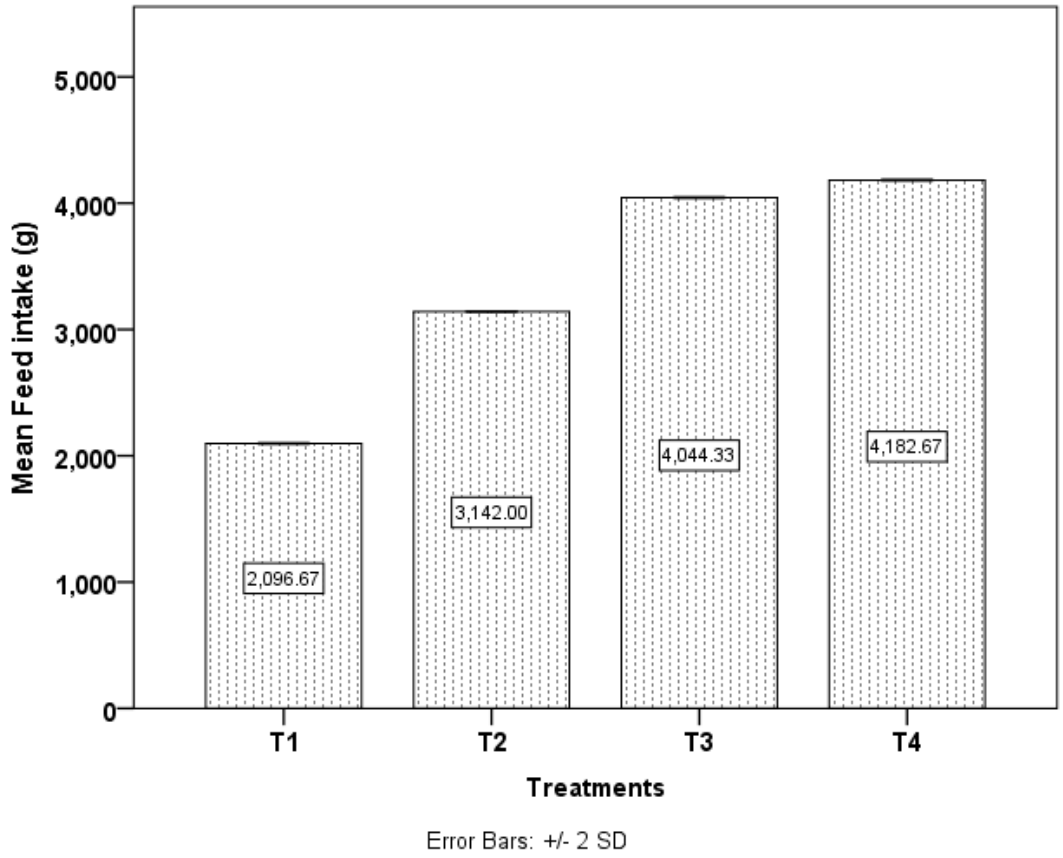

Fig. 1. Mean feed intake of broiler chicks subjected to different levels of honey and vitamin *C*
(T1= control; T2= 5 ml of honey in water; T3= 100 mg of vitamin C in water; T4= 5 ml of honey and 100 mg of vitamin C in water)

The result of the weight gain of broilers given honey and vitamin C for 10 weeks is presented in Table 2. The highest ($p<0.05$) weight gain was recorded in the broiler chicks in Treatment 4 (2013.333±374.09 g) followed by those in Treatment 2 (1717.33±382.718 g), Treatment 3 (1628.07±382.302 g) while the least weight gain was recorded in Treatment 1 (1422.00 g ±356.64). The result further revealed that the weight gain of broilers in Treatment 1 was significantly different ($p<0.05$) from other treatments except Treatment 3.

3.2 Specific Growth Rate

The result of the specific growth rate of broilers given honey and vitamin C for 10 weeks is presented in Table 2. The highest ($p<0.05$) specific growth rate was recorded in the broiler chicks in Treatment 4 (10.84±0.285 g%/day) followed by those in Treatment 2 (10.61±0.313 g%/day) and Treatment 3 (10.53±0.339 g%/day), while the least specific growth rate was recorded in Treatment 1 (10.33±0.363 g%/day). The data further revealed that the specific growth rate of broilers in treatment 1 was significantly different ($p<0.05$) from other treatments except Treatment 3.

3.3 Feed Conversion Ratio (FCR)

The result of the feed conversion ratio of broiler chicks given honey and vitamin C for 10 weeks is presented in Fig. 2. The highest feed conversion ratio was recorded in the broiler chicks in Treatment 1 (1.49±0.19) followed by those in Treatment 2 (1.85±0.23) and Treatment 4 (2.08±0.15) while the least feed conversion ratio was recorded in Treatment 3 (2.50±0.23). The analysis of variance revealed that there was significant difference ($p<0.05$) between the feed conversion ratio of broiler chicks in the four treatments after 10 weeks. The result further revealed that the feed conversion ratio of broilers in treatment 1 was significantly different ($p<0.05$) from other treatments.

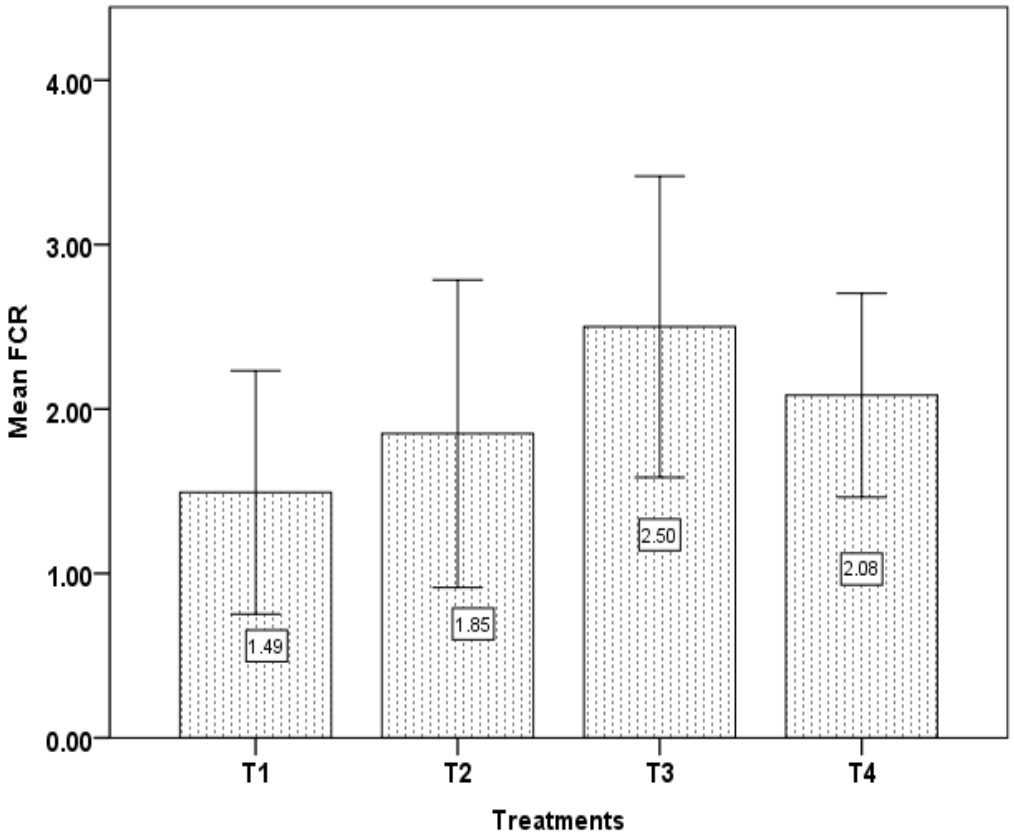

Fig. 2. Mean Feed conversion ratio of broiler chicks subjected to different levels of honey and vitamin C

(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.)

Table 2. Weight gain and specific growth rate of broiler chicks subjected to different levels of honey and vitamin C

Parameters	T1	T2	T3	T4
Initial mean weight gain (g)	606.27±165.765[a]	548.53±264.861[a]	575.27±211.18[a]	541.67±154.27[a]
Final mean weight gain (g)	2028.27±291.212[a]	2265.87±342.381[a]	2203.33±304.42[a]	2555.00±295.871[b]
Mean weight gain (g)	1422.00±356.64[a]	1717.33±382.718[b]	1628.07±382.302[ab]	2013.333±374.09[c]
Mean Specific growth rate	10.33±0.363[a]	10.61±0.313[bc]	10.53±0.339[ab]	10.84±0.285[c]

**Rows sharing similar superscripts are not significantly different from each other*

T1= control; T2= 5ml of honey in water; T3= 100mg of vitamin C in water; T4= 5ml of honey and 100mg of vitamin C in water.

4. DISCUSSION

The results of this study revealed that the feed intake of broilers was significantly higher in Treatment 4 when compared with other treatments. It was observed that the feed intake recorded in all the treatments was higher than the control. This supports the observation by previous researchers [26,27] who asserted that heat-stressed chickens fed vitamin C enhanced diets consumed more feeds than the control birds. The findings of this study in line with the findings of Njoku and Nwazota [28], who reported that including vitamin C in diet enhanced avian feed consumption. This improvement in feed intake may be attributed to the fact that the addition of honey and vitamin C boosted the appetite of the birds.

The result revealed that broilers subjected to Treatments 2,3 and 4 had significantly higher weight gain than the control. This implies that adding honey and vitamin C to the water of broilers improved the growth indices (weight gain, specific growth rate and feed conversion ratio) of broilers. Similarly, Nemati *et al.* [29] It was discovered that adding vitamin C to broiler diets under cold stress circumstances boosted body weight. This observation was in contrast with Abioja *et al.* [30] who reported that adding vitamin C has no influence on the growth rate of broilers.. Gross [31] earlier observed that dietary vitamin C improved growth performance in broilers. A different observation was made by Ozpinar *et al*. [32] who demonstrated that body weights of the broiler chicks were not influenced by the inclusion of vitamin C into their diet.

This study supports the findings of Oke *et al.* [8] who reported that the supplementation of honey in the drinking water for broiler chicks up to 60 ml during the hot dry season in the hot humid tropics improved body weight gain. The result of this study supports the findings of Osunkeye *et al*. [33] who observed that the introduction of honey in the broilers' food had a substantial effect on their average daily weight increase. This could be attributed to high nutritional impact honey and vitamin C had on the broilers.

The groups of birds supplemented with vitamin C showed better feed conversion efficiency than non-supplemented groups [27]. These results are supported by the findings of Njoku and Nwazota [28], who noted that vitamin C supplementation increased feed conversion ratio in chicks kept under naturally occurring summer temperatures. This study corroborates with that of Osunkeye *et al*. [33] who reported that the inclusion of honey in the diet of broilers significantly affected their average daily feed intake and feed conversion ratio.

5. CONCLUSION

This study on the effect of honey and vitamin C on the growth performance and blood parameters of broilers has revealed that the feed intake, weight gain, specific growth rate and feed conversion ratio of broilers were significantly affected with Treatment 4 having the highest values when compared with other treatments. 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 addition of 5ml of honey and 100mg of vitamin C in the drinking water of broilers by poultry farmers since it significantly affected the feed intake and growth performance of broilers than the control.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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