*International Journal of Agriculture and Environmental Research*

ISSN: 2455-6939

Volume: 05, Issue: 05 "September-October 2019"

# EFFECTS OF DIETARY INCLUSION OF VITAMIN C ON GROWTH PERFORMANCE AND HAEMATOLOGICAL INDICES OF BROILER FINISHER BIRDS

Osita, C.O.[1*]; Ani, A. O.[1]; Akuru, E. A.[1,2]; Edeh, H. O.[1]; Ezemagu, I. E.[1]; Ezenwosu, C [1] and Ukwueze, J. O.[1]

[1]Department of Animal Science, University of Nigeria, Nsukka, Nigeria.

[2]Department of Livestock and Pasture Science, University of Fort Hare, Alice 5700, South Africa.

*Corresponding Author

## ABSTRACT

The effects of Vitamin C supplementation on performance and haematological indices of broiler birds were investigated. A total of one hundred and twenty (120) day-old chicks were randomly allocated into four dietary treatments of thirty birds each. The treatments consisted of four levels of dietary Vitamins C supplement (0, 150, 250 and 350 mg/kg of basal diets). Each treatment has three replicates (ten broilers per replicate). There were no significant ($p>0.05$) differences among treatments in initial body weight and average daily feed intake while significant ($p<0.05$) differences existed among treatments in final body weight, average daily weight gain and feed conversion ratio. In haematological indices there were no significant ($P> 0.05$) differences among treatments in mean corpuscular hemoglobin concentration and mean corpuscular volume while significant ($P< 0.05$) differences existed among treatments in packed cell volume, haemaglobin concentration, mean corpuscular volume, and red blood cell count. In conclusion $T_3$ was recommended because the highest average daily weight gain and lower feed conversion ratio were recorded. Also, the values of packed cell volume, haemaglobin concentration and mean corpuscular volume in $T_3$ were significantly higher than that of control.

**Keywords:** Supplement, Chicks, Weight, Protein, Poultry.

## INTRODUCTION

The Food and Agricultural Organization (F.A.O.) of the United Nations stipulates a daily requirement of 65g to 75g of total protein out of which 35g should be obtained from animal sources (F.A.O., 1999). Presently the daily animal protein consumption in Nigeria falls short of FAO requirement. According to Ike (2011) poultry offers the greatest scope of increasing the

  

ISSN: 2455-6939

Volume: 05, Issue: 05 "September-October 2019"

quantity and quality of animal protein intake in Nigeria. Thus poultry meat and egg are capable of providing animal protein in terms of quantity and quality and can narrow down the animal protein supply gap in a minimum possible time. A rapid growing broiler needs to be supplied with sufficient amount of protein and carbohydrates, along with the necessary vitamins, dietary minerals and an adequate supply of water in order to meet its requirements for maintenance and growth of all components of the bird.

However, compared to other domestic animals, broiler chickens are more susceptible to changing environmental conditions (Nolan *et al*., 1999). In particular, high ambient temperatures depressed feed intake, weight gain and increased mortality rates among broilers (Ayo *et al*., 1996). A possible approach to counteracting the negative effects of heat stress among chickens could be the supplementation of birds with Vitamin C (Sahin *et al*., 2002).

Vitamin C also known as ascorbic acid is a water-soluble nutrient found in some food. In the body it acts as an antioxidant, helping to protect cells from the damage caused by free radicals. Vitamin C when included into broiler feed helps to improve the performance, strengthens wounds healing and absorption of iron. It plays a major role in enhancing the immune system.

Though, chickens can synthesize vitamin C, the synthesis was reported to be inadequate under stressful conditions such as low or high environmental temperature, high humidity, high production rate and parasite infestation (McDowell, 1989). Vitamin C play essential role in broiler production but it is not certain the exact level that should be used to obtain optimum performance from broilers. The present work is aimed at determining the effect of different levels of inclusion of Vitamin C on growth performance and haematological indices of broiler birds.

## MATERIALS AND METHODS

The study was carried out at the poultry unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. The study lasted four weeks.

### Experimental Animals and Management

One hundred and twenty 4 weeks old commercial broilers were used for the study. The birds were weighed and randomly allocated into four (4) treatment groups having thirty (30) birds per treatment in a completely randomized design. Each treatment was replicated three (3) times with ten (10) birds per replicate. Treatment 1 served as the control and did not contain any Vitamin C supplement, while treatments 2, 3, and 4, contained 150, 250, and 350 mg/kg of basal diet. Commercial broiler finisher diet was used. Clean water and feed were provided *ad libitum*. The required drugs and vaccinations were administered appropriately according to the vaccination

  

ISSN: 2455-6939

Volume: 05, Issue: 05 "September-October 2019"

routine for broilers. The experimental diets were assayed for proximate composition (Table I) by the method of A.O.A.C, (1990).

**Table 1: Proximate composition of the broiler finisher diet**

| Components (%) | |
|---|---|
| Dry matter | 90.05 |
| Crude protein | 20.05 |
| Crude fibre | 5.60 |
| Ash | 6.15 |
| Ether extract | 2.80 |
| Nitrogen-free extract | 57.45 |
| Gross Energy (Mcal/kg) | 2.89 |

The birds were weighed at the beginning of the experiment to determine their initial body weights. Body weights of the birds were taken on a weekly basis. Daily feed intake was obtained from the difference between the quantity of feed offered and that of the left over from the previous day divided by the number of birds per replicate. Feed conversion ratio (FCR) was then calculated as quantity (gram) of feed consumed per unit (gram) weight gained over the same period.

**Blood collection**

At the end of the experiment, six birds were randomly selected from each treatment. Five mls of blood was collected from the wing vein of each bird using a sterilized syringe and emptied into sterilized sample bottles containing the anti-coagulant ethylene diamine tetra acetic acid (EDTA) for laboratory analysis to determine hematological indices. The packed cell volume (PCV) was determined by the microhematocrit method (Thrall and Weiser, 2002). The haemoglobin concentration (HB) was determined by the cyanomethaemoglobin method (Higgins et al., 2008). The red blood cell (RBC) was determined by the haemocytometer method (Thrall and Weiser, 2002). The mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated using the standard formula (Schalm *et al*., 1975).

**Statistical Analysis**

  

ISSN: 2455-6939

Volume: 05, Issue: 05 "September-October 2019"

Data collected were subjected to analysis of variance in a completely randomized design as described by Steel and Torrie (1980). Significant differences between treatment means were separated using Duncan's New Multiple Range Test (Duncan, 1955).

## RESULTS AND DISCUSSION

Table 2 shows that there were no significant ($p>0.05$) differences among treatments in initial body weight, and average daily feed intake while significant ($p<0.05$) differences existed among treatments in final body weight, average daily weight gain and feed conversion ratio. The final body weight and average daily weight gain were highest in $T_3$ while in $T_1$ (control) the lowest final body weight and average daily weight gain were recorded. $T_2$ and $T_4$ had similar average final body weight and average daily weight gain. Similar feed conversion ratios were recorded in $T_1$, $T_2$ and $T_4$. $T_3$ had the lowest feed conversion ratio.

**Table 2: Effects of dietary inclusion of Vitamin C on growth performance of broiler finisher birds**

| | Treatment | | | | |
|---|---|---|---|---|---|
| Parameters | $T_1$(Control) | $T_2$(150mg/kg) | $T_3$(250mg/kg) | $T_4$(350mg/kg) | probability |
| Initial body weight (g) | 1042 | 1033 | 1048 | 1038 | .35 |
| Final body weight (g) | $2771.28^{c}$ | $3029.68^{b}$ | $3346.80^{a}$ | $3096^{b}$ | .04 |
| Av. daily feed intake(g) | 147.05 | 154.48 | 158.40 | 166.48 | .30 |
| Average daily weight gain(g) | $61.76^{c}$ | $71.31^{b}$ | $82.10^{a}$ | $73.50^{b}$ | .00 |
| Feed conversion ratio | $2.38^{a}$ | $2.16^{a}$ | $1.93^{b}$ | $2.27^{a}$ | .03 |

$^{abc}$Means on the same row with different superscript are significantly different ($p<0.05$).

The result of the present study is in agreement with Taweli and Kassab (1990) who reported that the supplementation of vitamin C did not affect feed intake. However, the result obtained in this study is in contrast with Tanveer *et al*. (2005) and Branton *et al.* (2004) who reported that supplementation of vitamin C in drinking water or feed increased feed intake of broiler birds.

  

ISSN: 2455-6939

Volume: 05, Issue: 05 "September-October 2019"

The increased body weight in supplemented groups is in agreement with Villar-Patino *et al*. (2002) who reported that weight gain and feed efficiency increased statistically with vitamin C supplementation. However, the result disagrees with the report of Bonsembinate *et al*. (2002) who showed that addition of Vitamin C and electrolyte in drinking water or feed did not alter the growth of broilers. The increased body weight gain might be due to feed digestion, absorption and metabolism of supplied feed nutrient especially protein essential for health and body weight gain. Villar-Patino *et al*. (2002) showed that Vitamin C in diet lowered feed conversion.

The result on table 3 shows that there were no significant ($p>0.05$) differences among treatments in MCHC and MCH while significant ($p<0.05$) differences existed among treatments in PCV, HB, MCV and RBC. The PCV, HB and RBC values of birds on $T_3$ and $T_4$ were similar but significantly ($p<0.05$) higher than those of birds on $T_1$ and $T_2$ .The MCV value for birds on $T_1$ was lower than that of birds on other treatment groups.

**Table 3: Effects of dietary inclusion of Vitamin C on haematological indices of broiler finisher birds**

| | Treatment | | | | |
|---|---|---|---|---|---|
| Parameters | $T_1$(Control) | $T_2$(150mg/kg) | $T_3$(250mg/kg) | $T_4$(350mg/kg) | Probability |
| PCV (%) | $18.77^b$ | $17.84^b$ | $31.38^a$ | $26.36^a$ | .03 |
| HB(g/dl) | $5.75^b$ | $6.75^b$ | $10.50^a$ | $9.75^a$ | .02 |
| MCHC(g/dl) | 33.89 | 34.15 | 33.57 | 33.39 | .88 |
| MCV(fl) | $8.94^b$ | $9.02^a$ | $9.02^a$ | $9.01^a$ | .00 |
| RBC ($10^6$/µl) | $1.17^b$ | $1.20^b$ | $2.48^a$ | $2.93^a$ | .04 |
| MCH(pg) | 3.05 | 3.08 | 3.01 | 2.88 | .34 |

$^{ab}$Means on the same row with different superscript are significantly different ($p<0.05$).

The finding of this study agrees with the work of Adenkola and Angani (2017) who reported that the supplementation of ascorbic acid in the diets of broilers increased the PCV, HB and RBC compared to the control group. The PCV increase may be attributed to the fact that vitamin C is part of a matrix involving many beneficial phytochemicals like cyanidin-3-glucoside, flavanones and carotenoids (Kurl *et al*., 2002). The slight increase in the PCV and HB of the supplemented group could be attributed to the ability of ascorbic acid to protect erythrocyte membrane integrity as reported by Gultekin *et al*. (2001). The lower value of packed cell volume, haemoglobin

  

ISSN: 2455-6939

Volume: 05, Issue: 05 "September-October 2019"

concentration and total erythrocytre count obtained in the control group may be attributed to the ability of vitamin C to maintain the integrity of erythrocyte membrane in vitamin C treated group (Ajakaiye *et al*., 2010) and also been able to scavenge for enormous amount of free radicals which is more in the control group.

## CONCLUSION

In conclusion, $T_3$ was recommended because the highest average daily weight gain and lower feed conversion ratio were recorded. Also the values of PCV, HB and RBC were significantly higher than that of control. The better performance of birds on diets supplemented with Vitamin C suggests that Vitamin C can be used by farmers to enhance poultry production.

## REFERENCES

Adenkola, A. Y., Angani, M. T. (2017). Ascorbic Acid Supplementation Effect on Haematology and Oxidative Stress Parameters of Broiler Chicken during the Hot-Dry Season in Southern Guinea Savannah. Journal of Poultry Research 14(1): 28-33, 2017

Ajakaiye, J.J., Perez-Bello, A. and Mollineda-Trujillo, A. 2010. Impact of vitamin C and E dietary supplementation on leukocyte profile of layer hens exposed to high ambient temperarure and humidity. Act Vet Brno, 79: 377 – 383.

A.O.A.C (1990). Official Methods of Analysis (15$^{th}$ edition). Association of Official Analytical Chemist, Washington D.C.

Ayo, J. O., Oladele, S. B. and Fayomi, A. 1996: Effect of heat stress on livestock production: A review. *Nigerian Veterinary Journal*, Special edition, 1: 58-68

Bonsembiante, M., Chiericato, G.M. and Rizzi, C. 2002: Influence of different sodium bicarbonate dietary contents on the metabolic profile, productive performance and meat quality of broilers. *Rivista-di-Avicoltura*, 71: 33-42.

Branton, S.L., Reece, F.N. and Deaton, J.W. 2004: Use of Ammonium chloride and Sodium bicarbonate in acute heat exposure of broilers. *Poultry Science*, 65: 1659-1663.

Duncan, D.B.(1955). Multiple Range and Multiple F- Tests. Biometrics, 11: 1-42.

Food and Agriculture Organization. (1999). Livestock for Food, Income, Employment and Sustainable Agriculture. FAO Animal Production and Health Division, Rome Italy.

Gultekin, F., Delibas, N., Yasar, S. and Kilinc, I. 2001: *In vivo* changes in antioxidant systems and protective role of melatonin and a combination of vitamin C and vitamin E on

  

oxidative damage in erythrocytes induced by chlorpyrifos-ethyl in rats. *Archives of Toxicology*, 75: 88-96.

Higgins, T., Beutler, E. and Doumas, B. T. (2008). Measurement of haemoglobin in blood. . In: Schalm, O. W., Jain, N. C. and Carol, E. J. (1975). Veterinary Haematology (3rd edition). Lea and Febringer, Philadelphia, USA.

Ike, P.C. 2011: Resource Use and Technical Efficiency of Small Scale Poultry Farmers in Enugu State, Nigeria: A Stochastic Frontier Analysis. *International Journal of Poultry Science*, 10: 895- 898.

Kurl, S., Tuomainen, T. P. and Laukkanen, J. A. 2002: Plasma vitamin C modifies the association between hypertension and risk of stroke. *American Heart Association Journal*, 33:1568-73.

McDowell, L. R. (1989). Vitamins in Animal Nutrition (2nd edition). Academic Press, London, UK.

Nolan, J., Hinch, G., Twaites, J. and Walkden-Brown, S. 1999. Constrains to animal production, Chapter 2: Climatic constrains, Lecturer Paper 12, Animal Science Group Publisher, Australia

Sahin, K. O. Kucuk, N. Sahin and M. Sari. 2002: Effects of Vitamin C and Vitamin E on Lipid Peroxidation Status, Some Serum Hormone, Metabolite, and Mineral Concentrations of Japanese Quails Reared Under Heat Stress (34°c). *International Journal Vitamin Nutrition Research*, 71::91-100.

Schalm, O. W., Jain, N. C. and Carol, E. J. (1975). Veterinary Haematology (3rd edition). Lea and Febringer, Philadelphia, USA.

Steel, R.G.D. and Torrie, J.H. (1980). Principles and Procedures of Statistics (2nd edition). McGraw-Hill Book Co. Inc. New York.

Tanveer, A., Sarwar, M., Mahr, U.N., and Ahsan, U.H. 2005: Influence of varying sources of dietary electrolytes on the performance on broiler reared in a high temperature environment. *Animal Feed Science and Technology*, 120: 277-298.

Taweli al and R N: Kassab, A. 1990: Effect of dietary vitamin C on ascites in broiler chicks. *International Journal of Vietnamese Nutritional Research*, 60: 366-371.

  

ISSN: 2455-6939

Volume: 05, Issue: 05 "September-October 2019"

Thrall, M.A and Weiser, M.G. (2002). Haematology. In: Laboratory procedures for veterinary technicians (4th edition). Hendrix CM, Missouri: Mosby Inc, pp. 29–74.

Villar-Patino, G., Diaz-Cruz, A., Avila-Gonzalez, E., Guinzberg, R., Pablos, J. and Pina, E. 2002: Effects of dietary supplementation with vitamin C or vitamin E on cardiac lipid peroxidation and growth performance in broilers at risk of developing ascites syndrome. *American Journal of Veterinary Research*, 63: 673-676.

  