APRW -06

Effect of Oral Supplementation of L-Arginine on the Hematological Indices of Shika Brown Chickens

R.A. Animashahun, O.O., Alabi, A.J., Shoyombo, M.A., Ayeni, A.Y. Adesina and A.C. Bolaji
Department of Animal Science, Landmark University, PMB 1001, Omu-Aran, Kwara State, Nigeria
Corresponding author: E-mail: animashaun.rasaq@lmu.edu.ng GSM: 08037141094

Abstract
This study was carried out to evaluate the effect of oral administration of L-Arginine (amino acid) on the blood profile of Shika brown birds. A total of 99 (twelve weeks old) unsexed Shika Brown strains of birds were randomly divided into three experimental groups having three replicates per treatment and 11 birds per replicate in a completely randomized design (CRD). Oral L-Arginine was added into the drinking water of the birds at three levels (0, 167 and 33 mg/l) for 5 weeks. At the end of the 5th week blood samples were collected through decapitation of the birds and were taken to the laboratory for analysis. The result showed that all the hematological parameters of the birds except the mean corpuscular hemoglobin concentration were significantly ($p<0.05$) affected at all levels. The oral supplementation of L-Arginine enhances the production of red blood cell, hemoglobin, and packed cell volume at 167 mg/l of arginine in water It was concluded that the oral supplementation up to 167mg/l of L-Arginine in water can be given to the birds to enhance the performance and biochemical activities of poultry birds.

Keywords: L-Arginine, Shika brown chicken, hematology

Introduction

Hematological and biochemical analysis of an animal's blood represent a good diagnostic aid for the assessment of physiological, nutritional and pathological conditions of animals (Babatunde and Olusanya, 1992). WHO recommended the use of blood parameters for medical and nutritional assessments because the blood contains several metabolites which provide useful information on nutritional status and clinical investigation of an individual (WHO, 1963; Egbunike *et. al*., 2009).The impact of blood in the physiological, neurotic and nutritious status of animals cannot be overemphasized; the various functions of blood in the body include the following: transport of hormone and metabolites, thermo control and homeostasis.

L-Arginine (L-Arg.), a ubiquitous basic amino acid, is necessary for maintenance, growth, reproduction, and immunity (Wu, 2009).). Poultry are not able to synthesize arginine themselves, and therefore completely depend on dietary arginine to meet their arginine needs for protein synthesis and other functions (D'Mello and Lewis, 1971). In addition, arginine becomes the most important amino acid when lysine is adequate in diet. Arginine plays a vital role in the modulation of protective immune response (Tayade *et al.,* 2006), and it is an important substrate for the immune system (Amato and Humphrey, 2010). Cengiz *et al.* (2010) found that Arginine supplementation reduced proteinemia, and modified erythrocyte characteristics, increasing their mean volume and reducing mean corpuscular hemoglobin load. Perez-Carbajal *et al.* (2010) found that arginine fed at levels higher than those recommended by the NRC could play a complementary role in the innate and humoral immune responses, potentially enhancing the immune response to field infections. Other benefits in human include reduction in the risk of coronary heart disease, reducing risk for heart attack, improvement in athletic ability, boosting of immunity, enhancement of kidney functioning, improving mental capabilities, helping to fight against dementia, fighting impotency, weak erection and male infertility, curbing inflammation, prevention of common cold, etc. The aim of this study therefore, is to study the effect of oral administration of L-Arginine on the hematology and biochemical profiles of Shika brown chickens.

Materials and Methods

Experimental location: The study was carried out at the Poultry Unit of the Teaching and Research Farm of Landmark University, Omu-Aran, Kwara State for the duration of five (5) weeks.Experimental birds and management: A total of 99 unsexed 12 weeks old Shika Brown chickens were procured and used for the experiment. Birds were raised in a deep litter pen partitioned into different treatments and replicates. The house, feeders and drinkers were properly washed and disinfected before the arrival of birds, while washing of drinkers continued every day of the experiment. Routine medication, vaccination and other management practices were carried out as at when due throughout the duration of the experiment.Birds were fed commercial grower's feed having 16% CP and 2450 (kcal/kg) Metabolizable energy level and the trial lasted for 5-weeks while birds were fed *ad libitum*.L-Arginine was given as an oral supplementation in drinking water of the birds daily at three levels for 5weeks as follow: Treatment A 0 mg/l, Treatment B 167 mg/l and Treatment C 333 mg/l.

At the end of theexperiment, three birds were randomly selected from each replicate on weight equalization basis and blood samples were collected terminally from each of them through decapitation. About 5 ml of blood samples were collected from each bird into a labeled EDTA specimen bottles for hematological indices determination. Packed cell volume (PCV), red blood cell count (RBC), leucocytes (WBC) and hemoglobin (Hb) were determined by Wintrobe's microhaematocrit, improved

Neubaeur haemacytometer and cyanometamoglobin methods respectively; while mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) weredetermined by Jain (1986).

Data obtained was subjected toanalysis of variance. Where significant differences occurred, the means were separated using Duncan multiple range F-test of the SAS 2000.

Results and Discussion

The values observed for RBC and PCV (Table 1) were significantly ($p< 0.05$) highest intreatment B with respective values of 4.42 ($\times10^{12}$/l) and 54.57%. The hemoglobin (Hb) values of17.34 and 18.19 g/dl obtained in treatments A and B are statistically similar; lowest value of 14.87 g/dl was observed in treatment C, however the value is within the normal range. Generally, there is drop in the values of RBC, PCV and Hb at higher dose of 333 mg/l (treatment C). Chineke *et al.* (2006) reported that high PCV reading indicated either anincrease in the number of circulating RBC or reduction in circulating plasma volume. An elevated hematocrit may also be caused by an absolute increase in blood cells, called polycythemia; this may besecondary to a proliferation of blood-forming cells in the bone marrow (DeMoraville and Best, 2013).The result of this study showed that oral administration of L-Arg. in Shika brown chickens enhances erythropoiesis which may consequently improve the physiological status of the chickens (Khan and Zafar, 2005); it has also been reported that animals with good blood composition are likely to show good performance (Isaac *et al.*, 2013). Also, Hazim and Atta(2012) opined that arginine can be used as effective feed additive for improving productive performance of broiler chickens; while Xiaoxue *et al.* (2015) indicated that the diet with 1.36% digestible arginine helps to optimize the nutritional needs of a female broiler breeder during thelate laying period.

Table 1: Blood composition of Shika brown chickens with oral supplementation of L-Arginine

Parameters	T A	T B	T C	SEM	LOS
RBC ($\times10^{12}$/l)	2.26^{b}	4.42^{a}	3.05^{b}	0.399	*
PCV (%)	52.04^{a}	54.57^{a}	44.66^{b}	1.916	*
HB (g/dl)	17.34^{a}	18.19^{a}	14.87^{b}	0.635	*
MCV (fl)	23.03^{a}	12.35^{b}	14.64^{b}	1.525	*
MCH (pg)	76.70^{a}	41.10^{b}	48.80^{b}	5.080	*
MCHC (g/dl)	33.30	33.30	33.20	0.125	NS
WBC ($\times10^{3}$/l)	248.47^{a}	228.77^{b}	232.80^{b}	5.095	*
Platelets (%)	6.67^{a}	2.67^{b}	2.67^{b}	0.192	*

SEM= Standard error of mean; LOS= Level of significance; *= $p<0.05$; a,b,c,= means with different superscripts along the same rows are significantly ($p<0.05$); NS= Non significant ($p>0.05$);

The values for MCV, MCH and WBC were statistically lower in birds thatwere given oral administration of L-Arg. i.e. treatments B and C, but increasing the levels of L-Arg. didnothave any significant impact on these parameters. The values for MCV and MCH in this study are higher than 12.8 fl and 47.9 g/dl respectively obtained by Adeyemo and Sani (2013), but in agreement with Elagib and Ahmed, (2011). Low MCV and MCHare indications of microcytic anemia (Adebiyi, 2007).The values obtained for MCHC is in agreement with normal values for chicken.The Mean Corpuscular Hemoglobin Concentration (MCHC) gives the average concentration ofhemoglobin in the red blood cells. The non-significant values observed across the treatments pointed outthat the oral supplementation of L-arginine may not influence the concentration of hemoglobin in thered blood cells.The RBC indices (MCV, MCH and MCHC) are useful indiagnosing various forms of anemia.The reduction in the levels of WBC in the birds that were supplied with arginine may not beunconnected with the role of L-arginine in boosting the immunity level of animals; (Park *et al.,* 1991).

The WBC obtained in this study is higher than those reported by Duwa*et al.* (2012) and Abdulazeez *et al.* (2016). Since WBC are known to fight against diseases, the result of this study indicates that birds onoral L-Arg. have the capacity to protect the birds against diseases and infection. WBC is alsoresponsible for animal immunity, the Studies on dietary Arg. show a wide range of its immunomodulating properties (Tong and Barbu,l 2004).

Conclusion and Recommendation

The oral supplementation of L-Arginine in water improved the hematological indices of the birds without having any adverse effects on blood parameters. Since the positive effects of the L-arginine on the hematology were greatly observed at the 167 mg/l of L-arginine level of administration, farmers could be encouraged to use L-arginine for better performance of chickens. L-Arg. could also be administered in cases of anemia to boost blood production. There is also need for further study to optimize the level of L-Arg. that will give the best benefit; this could be achieved by using a range less than 167 mg/l and lower than 333 mg/l.

References

Abdulazeez, H., Adamu, S.B., Igwebuike, J.U.,Gwayo, G.J. and Muhammad, A.I. (2016). Hematology and serum biochemistry of broiler chickens fed graded levels of baobab (*Adansonia digitata* L.) seed meal. *IOSR Journal of Agriculture and Veterinary Science*, 9: 48-53.

Adeyemo, I.A. and Sani A. (2013). Hematologicalparameters and serum biochemical indices of broiler chickens fed *Aspergillus niger* hydrolyzed cassava peel meal based diet. *International Journal of Recent Research and Applied Studies,* 15 (3): 410-415.

Amato, J.L. and Humphrey, B.D. (2010). Dietary arginine levels alter markers of arginine utilization in peripheral blood mononuclear cells and thymocytes in young broiler chicks. *Poultry Science,*

Babatunde, B.B. and Olusanya,(1992). Rubber seed oil vs. Palm oil in broiler chickens diet. Effect on performance, nutrient digestibility, hematology and carcass characteristics. *Feed Science and Technology,* 35: 133- 146.

Cengiz, O., Kucukersan, S. (2010). Effects of graded contents of arginine supplementation on growth performance, hematological parameters and immune system in broilers. *Reviews in Medical Veterinaire,*

Chineke, C.A., Ologun, A.G. and Ikeobi, C.O.N. (2006). Hematological parameters in rabbit breeds and crosses in humid tropics. *Pakistan Journal of Biological Sciences,* 9:2102-2106.

Demoranville, V.E. and Best, M.A. (2013). Haematocrit. Encyclopedia of Surgery: A guide for patients and caregivers. Available at: enwikipedia.org/

D',Mello, J.P. and Lewis, D. (1971). Amino acid interactions in chick nutrition. 4. Growth, food intake andplasma amino acid patterns. *British Poultry Science;*

Duwa, H., Oyawoye, E.O. and Njidda, A.A. (2012). Hematologicalresponses and serum biochemical indices of broilers fed differently processed sorrel seed (*Hibiscus sabdariffa*) meal in semi-arid region of Nigeria. *British Journal of Poultry Sciences,* 1(1): 05-10.

Egbunike, G.N., Agiang, E.A.,Owosibo, A.O. and Fafute, A.A. (2009). Effects of protein on performanceand hematology of broilers fed cassava peel based diets. *Archivos de Zootecnia,* 58(224): 656.

Elagib, H.A.A. and Ahmed, A.O.A. (2011). Comparative study on hematological values of bloodfor indigenous chickens in Sudan. *Asian Journal of Poultry Science,* 41-45

Hazim, J. and Atta M.S. (2012). Effect of dietary l-arginine on productive performance of broiler chickens.*Pakistan Journal of Nutrition,* 11: 252-257.

Isaac, L.J., Abah, G., Akpan, B. and Ekaette, I.U. (2013). Hematological properties of different breeds and sexes of rabbits. Proceedings of the 18th Annual Conference of Animal Science Association of Nigeria.Pp: .24-27.

Jain, N.C. (1986). *Schalm's Veterinary hematology,* 4th Edition. Lea and Ferbiger, Philadelphia.

Tayade, C., Jaiswal, T.N., Mishra, S.C., Koti, M. (2006). L-Arginine stimulates immune response in chickens immunized with intermediate plus strain of infectious bursal disease vaccine. *Vaccine,* 24(5):552-560.

Khan, A.T. and Zafar, F. (2005). Hematologicalstudy in response to varying doses of estrogen in broiler chicken. *International Journal of Poultry Science,* 4: 748-751.

Park, K.G., Hayes, P.D., Garlick, P.J., Sewell, H. andEremin, O. (1991). Stimulation of lymphocyte natural cytotoxicity by l-arginine. *Lancet,* 337(8742):645–6.

Perez-Carbajal, C., Caldwell, D. and Farnell, M. (2010). Immune response of broiler chickens fed different levels of arginine and vitamin E to a coccidiosis vaccine and eimeria challenge. *Poultry Science,* 89(9):1870-1877.

Tong, B.C. and Barbul, A. (2004). Cellular and physiological effects of arginine. Mini-reviews. *Medicinal Chemistry,* 4(8): 823 – 832.

WHO (1963). Technical report series. No.842 (Expert committee on medical assessment and nutritional status). World Health Organization, Geneva.

Wu, G. (2009). Amino acids: metabolism, functions, and nutrition. *Amino Acids,* 37:1–17.

Xiaoxue, D., Li, F., Mou, S., Feng, J., Liu, P. and Xu, L.(2015). Effects of dietary L-arginine on laying performance and anti-oxidant capacity of broiler breeder hens, eggs, and offspring during the late laying period. *Poultry Science*, 94:2938–2943.