



Histological analysis of the heart and lungs of kuroiler birds fed graded levels of l-arginine supplement

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Abstract

L-Arginine an amino-acid is reported to have lots of immune functions and growth performance in animals and humans when used within normal range. However, there is no information on the effect of usage of high levels of L-Arginine supplement on the heart and lungs of chickens; hence the objective of this study is to ascertain the effect of high levels of L-arginine supplement on the heart and lungs of kuroiler birds. Employing completely randomized design (CRD), the study was carried out using 99 kuroiler birds of twelve-weeks old, the birds were randomly distributed into three treatments and three replicates with eleven birds per replicate. Feed and water was given daily, 1.4kg of feed and 3litres of water per replicate supplemented with or without L-Arginine. The birds in treatment 1 were given 3 litres of water with 100mg of L-Arginine supplement. The birds in treatment 2 were given 3 litres of water supplemented with 500mg of L-Arginine and the birds in treatment 3 were given 3 litres of water supplemented with 1000mg of L-Arginine for a period of five consecutive weeks, after which the birds were decapitated. The heart and lungs were removed and taken to histopathological laboratory using Binocular Olympus Model CX21FSI Microscope and 12Mega Pixel Samsung Camera for photomicrographs. The histological analysis of chickens on treatment 2 and 3 of L-arginine supplement shows congestion of vascular channels and perivascular haemorrhage of the heart and lungs. Over dose of L-arginine supplement can lead to dysfunctional effect of the heart and lungs.

KEYWORDS: L-Arginine, Kuroiler; Heart; Lung; Histological analysis.

Introduction

Arginine (Arg), a ubiquitous basic amino acid, is necessary for maintenance, growth and reproduction. L-arginine is an essential amino acid of poultry; it has been proven to improve performance, carcass quality (Al-Daraji and Salih, 2012) and immunity in chickens. It is conditionally essential in most mature mammals due to their renal synthesis but avians fail to synthesize it because they lack the key enzyme carbamoyl phosphate synthase. 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. 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 and it is an important substrate for the immune system (D'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. The Kuroiler chicken is a dual purpose hybrid breed developed in India. It was produced by crossbreeding either White Leghorn roosters with Rhode Island Red hens, or colored broiler roosters crossed with Rhode Island Red hens (Kienyeji, 2015).



Materials and methods

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. The geographical coordinates are Latitude 8.9 °N and Longitude 50.61° E. A total of ninety nine (99) 12 weeks old Kuroiler chickens were used for the study. Thirty three (33) chicks each were assigned to each of the three treatments (1, 2, and 3) randomly subjected to three (3) treatments of graded levels of L-arginine oral inclusion (100mg, 500mg and 1000mg) in a completely randomized design (CRD). Each treatment group contained three replicates of (11) chickens each. All the chickens were raised in a clean deep litter compartment; Feed and water was given daily, 1.4kg of feed and 3litres of water per replicate, the chickens had access to orally supplemented L-arginine. Routine vaccination, medication, and other management practices were carried out. Feed and water intake were measured daily. After 5weeks, the birds were decapitated and the organs (the heart and lungs) were collected. The organs were put in formaldehyde buffer solution in well labeled containers. The heart and lungs were taken to histopathological laboratory for histological analysis. Data collected were analyzed using Statistical Analysis System program and for the histological analysis, Binocular Olympus Model CX21FSI Microscope and 12Mega Pixel Samsung Camera were used for photomicrographs.

Results and discussion

There was no notable change in the heart of birds administered 100mg of L-Arginine, as seen in the Plate 1. The heart of the bird administered 500mg of L-Arginine supplement, showed congestion of the vascular channels indicating an alteration in the normal structure of the heart, as shown in the Plate 2. Plate 3 shows the heart of birds administered 1000mg L-Arginine supplement, the heart has haemorrhage within the cardiac muscle, altering the normal structure of the heart. Plate 4 shows the lung of the kuroiler bird administered 100mg of L-Arginine, the histological plate shows normal structure of the lung without any form of lesion. Plate 5 shows alteration in the lung structure with numerous congested vascular channels of kuroiler bird administered 500mg dose of L-Arginine. An alteration was observed in Plate 6 of the lung of the kuroiler bird administered 1000mg dose of L-Arginine supplement, where mononuclear inflammatory infiltration was visible with an attempt at follicle formation.

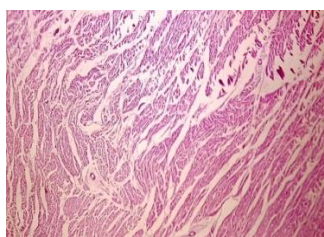


PLATE 1

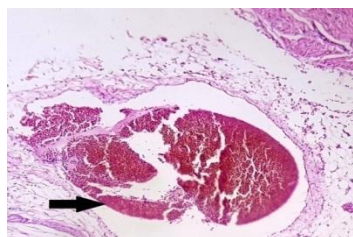


PLATE 2

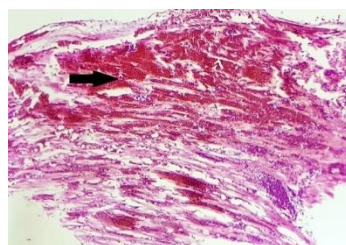


PLATE 3

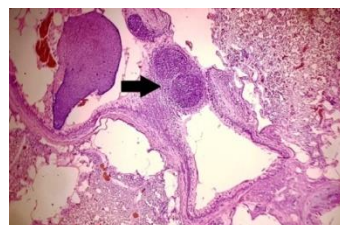
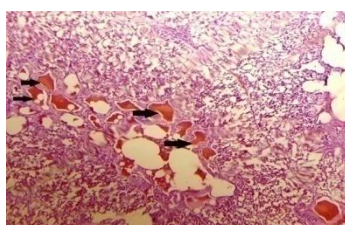
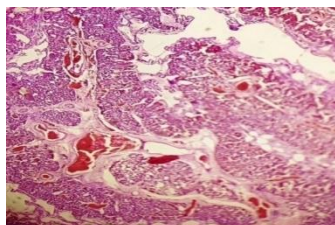




PLATE 4

PLATE 5

PLATE 6

L-Arginine is known for its decisive role in the controlling of effector lymphocytes and ability to increase NO production, giving rise to an impaired coagulation and vasodilation at the endothelial site subsequently. The heart structure of the kuroiler bird administered 500mg of L-Arginine showed congestion in the vascular channels this is due to excess administration of the amino-acid which is responsible for the production of NO. The haemorrhage within the cardiac muscle seen in the heart of the kuroiler bird administered 1000mg is in line with Egbuonu *et al.*, (2013). Excess NO production in the endothelium leads to vascular permeability, which may result in the haemorrhage and disruption observed in the birds (Morbideilli *et al.*, 2004). Chronic tissue inflammation is associated with various body parts including the lungs and long-term exposure of this organ to NO may promote carcinogenesis as reported by Lala *et al.*, (2001)

Table 1: Effects of l-arginine on growth feed and water consumption

Arginine levels	100mg	500mg	1000mg	SEM	LOS
TWC (ml)	16578.44±312.55	16393.87±322.04	16782.71±324.15	1210.48	NS
TQAC (mg)	584.20 ^c ±96.17	2920.99 ^b ±99.09	5370.75 ^a ±99.74	372.46	***
AWC (ml/bird)	1507.13±307.98	1490.45±317.34	2125.40±319.42	1192.81	NS
AQAC (mg/bird)	52.91 ^c ±8.86	265.54 ^b ±8.94	486.88 ^a ±9.00	33.61	***
TFC (g)	9447.69±78.47	9154.38±80.85	9416.84±81.38	303.91	NS
AFCB (g/bird)	858.88±7.13	832.18±7.35	856.04±7.40	27.62	NS
FCR	1.93±0.27	2.01±0.28	2.01±0.27	0.38	NS
TBWT (Kg)	17.88±0.28	17.50±0.28	18.38±0.28	1.08	NS
ABWT (Kg/bird)	1.66±0.14	1.67±0.14	1.72±0.14	0.53	NS

^{abc} means differ significantly (p<0.0001) across treatment levels. NS: not significant

* Total Water Consumed (TWC), Total Quantity of Active ingredient Consumed (TQAC), Average quantity of Water Consumed (AWC), Average Quantity of Active ingredient Consumed (AQAC), Total Feed Consumed (TFC), Average Feed Consumed per Bird (AFCB), Feed conversion ratio (FCR), Total Body Weight of birds per Treatment (TBWT) and Average Body Weight (ABWT).



The results shows that the highest water intake was at 1000mg arginine dosage, this may be connected with the fact that the dissolved solute impacts on thirst and encourage further drinking in the experimental birds. Feed conversion ratio is a measure of feed utilization or the efficiency of converting unit feed into unit gain.

Conclusion

It can be concluded from the results obtained in this study that there was dysfunctional effect of high levels (500mg and 1000mg) of L-Arginine on structure of the heart and lungs of kuroiler chickens, which can be used by health worker to advice humans against the use of high dose of L-Arginine.

Acknowledgement

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