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# Effects of L-Arginine supplementation of drinking water on the kidney and liver of Sasso chickens

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**The present study was conducted to determine the effects of L-arginine supplementation of drinking water on the kidney and liver of Sasso chickens. The study comprised 297 mixed sex Sasso chickens of twelve-weeks old raised in floor pens; the birds were randomly distributed into three treatments and three replicates with thirty-three birds per replicate. The design of the experiment is the completely randomized design (CRD). The birds were fed grower's mash and given different treatment of 0 mg/L (Treatment A at 0% supplementation), 167 mg/L (Treatment B at 50% supplementation), and 334 mg/L (Treatment C at 100% supplementation) of L-arginine supplement in drinking water of 9 L per replicate daily for a period of five consecutive weeks, after which the birds were decapitated. The kidney and liver were removed and taken to histopathology laboratory for histological analysis. The chickens administered 0 mg/L L-arginine (0%) supplementation was without lesions. However, kidney and liver of chickens that received 167 mg/L (50%) and 334 mg/L (100%) supplementation showed explicit damage. There was congestion of the vascular channels in the kidneys and liver of birds that received 167 mg/L of L-arginine and destruction of the glomeruli and tubules in the kidney and peri portal mononuclear inflammatory infiltration in the liver of those given 334 mg/L of L-arginine. This could possibly be a result of the over-expression of nitric oxide which is a vasodilator. These present findings showed that supplementing the diets of Sasso chickens with L-arginine of 50 and 100% have detrimental effect on the structure and functions of the kidney and liver.**

**Key words:** L-Arginine, Sasso chickens, kidney, liver, dosage.

## INTRODUCTION

Good meat quality attracts favorable attention from consumers as compared to meat with excess fat and excess fat deposition is a major factor of poor meat quality of broilers. Excess fat can result in reduction of carcass yield and difficulties in processing. White meat such as chicken meat is considered superior for health reasons to red meat because of comparably low contents of fat, cholesterol and iron. Manipulation of trait depends on the combined genetic and nutrition. Some of the selection strategies results in accumulation of excessive fat in the body that negatively affects production efficiency, consumer perception and marketability of

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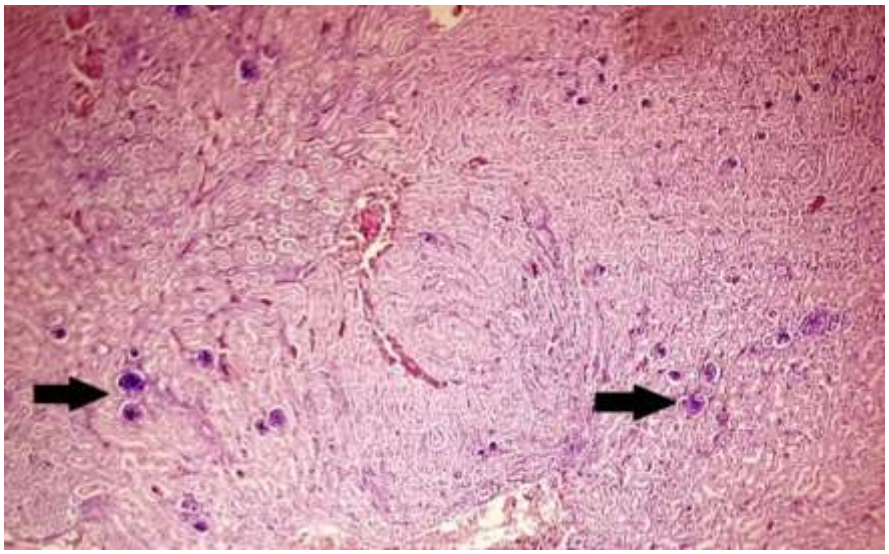

**Plate 1.** Kidney with 0 mg/L intake showing normal tissues with glomureli and tubules, H&E X100.

chickens (Zhou et al., 2006). The success in poultry meat production has been strongly related to improvements in body growth and carcass yield, mainly by increasing breast proportion and reduction in abdominal fat. Al-Daraji et al. (2011) demonstrated that increasing L-arginine supplementation level in broilers diet reduced total body fat deposition (Hyun-Seek et al., 2017). L-Arginine, an amino-acid reported to be the sole precursor of nitric oxide, with lots of immune functions (Kang et al., 2014) and growth performance. Nitric oxide (NO) plays an important role in modulating both the hepatic and renal circulation under physiological and pathological conditions. Addition of L-arginine in poultry diets is required to avoid the harmful influences of excessive free radicals produced during normal metabolism (Atakisi et al., 2009). Methionine and arginine are two amino acids that have proven immune regulatory action (Tayade et al., 2006). Arginine is involved in a number of other metabolic functions in the body, such as its potential to be converted to glucose (hence, its classification as a glycogenic acid), and its ability to be catabolized to produce energy (Tan et al., 2014; Tong and Barbul, 2004). It is also a vasodilator (Melik et al., 2016). Dietary L-arginine supplementation plays key role in enhancing meat quality. It was recently demonstrated that L-arginine increases specific immune response against infectious bursal disease (IBD) in chickens (Jeffery et al., 2014). In the liver, nitric oxide synthase (NOS) may be expressed by hepatocytes, cholangiocytes, hepatic stellate cells, and Kupffer cells (Trauner and Boyer, 2003). NO is able to exert dichotomous effects under physiological and pathological conditions. The induction of NOS in phagocytic cells by a variety of noxious stimuli may lead to high and sustained levels of NO, which may cause cytotoxicity through nitrosative stress (Pacher et al., 2007). The aim of this study is to determine the effect of L-arginine on the kidney and liver of Sasso chickens.

## MATERIALS AND METHODS

This experiment was carried out at the Poultry Unit of Landmark University Teaching and Research Farms, Omu-Aran, Kwara State, Nigeria. A total of 297 mixed sex Sasso chickens were used for the study. The chickens were randomly distributed into three treatments containing three replicates of thirty-three birds each in a completely randomized design (CRD). The birds were fed with grower's mash and given different treatment of 0 mg/L (Treatment A at 0% supplementation), 167 mg/L (Treatment B at 50% supplementation) and 334 mg/L (Treatment C at 100% supplementation) of L-arginine supplement in drinking water of 9 L per replicate daily for a period of five consecutive weeks; after 5 weeks, three birds from each treatment was decapitated at the Landmark University Teaching and Research Farms, the organs were removed and put in 10% phosphate buffered formaldehyde buffer solution in well labeled containers. The organs (kidney and liver) were taken to Federal Medical Center, Lokoja Histopathology Laboratory for analysis. For histopathological analysis, the tissue samples (the kidney and liver), were fixed in neutral phosphate buffered 10%-formalin solution, embedded in paraffin and 4 mm thick sections were prepared. After deparaffinization, the sections were stained with haematoxylin and eosin (HE). The slices were examined under the light microscope and images were captured with digital camera at the magnification of 100.

## RESULTS AND DISCUSSION

After carrying out the histological analysis on the kidney, there was no notable change in the heart of Sasso chickens administered treatment A, no dose of L-arginine (Plate 1).

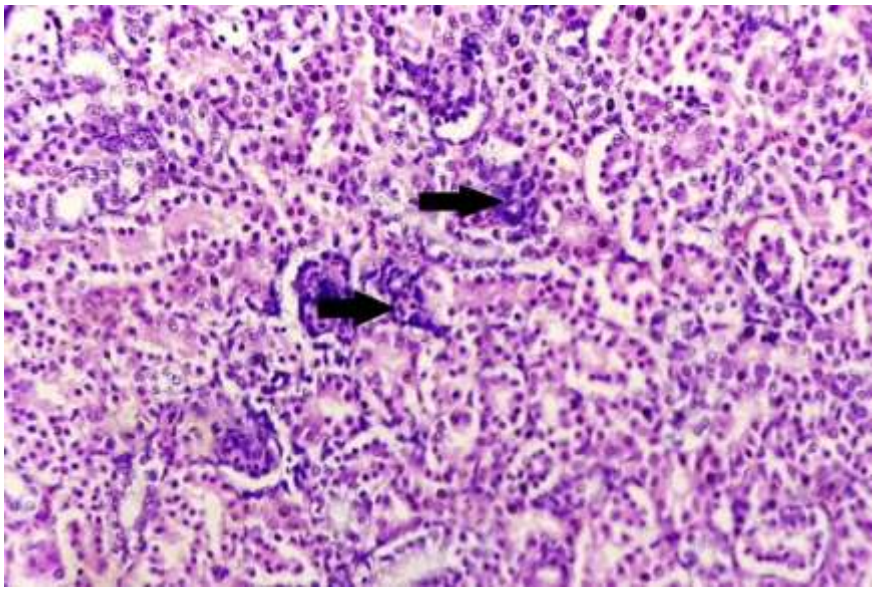

**Plate 2.** Destruction of renal vascular channels with 167 mg/L intake, H&E X100.

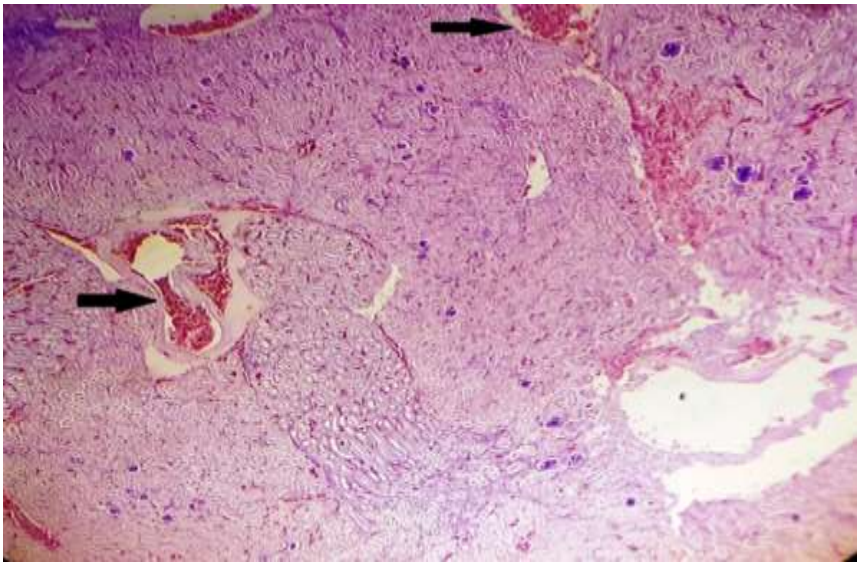

**Plate 3.** Kidney having congested vascular channels with 334 mg/L intake, H&E X100.

Findings showed that the microscopic structure of the kidney of Sasso chickens given 0 mg/L has typical structure with no lesion as reported by Wideman (2001). Although, it was reported that increasing L-arginine level in broilers diet reduced total body fat deposit (Hyun-Seek et al., 2017), However, the kidney structure of chickens given 167 mg/L of L-arginine showed congestion of vascular channels, destruction of the glomeruli and tubules in line with Pacher et al., (2007). L-arginine caused desquamation of the epithelial cells lining the tubules with lymphoid follicle formation in the interstitium, which is the shedding off of the outermost layer of the tissue in all replicates given 334 mg/L, in line with Johnson (1979). Plate 4 shows a typical structure with no lesion as reported by Trauner (2003). The liver in Plate 5 shows the liver under 167 mg/L intake had congested vascular spaces. The liver in Plate 6 shows that the liver under 334 mg/L intake had congested vascular spaces

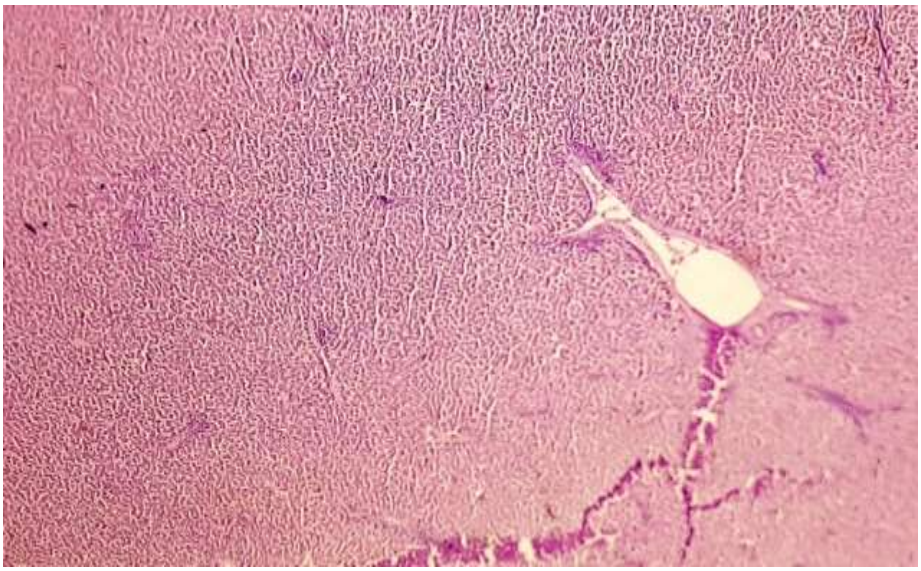

**Plate 4.** 0 mg/L intake showing normal liver cords, H&E X100.

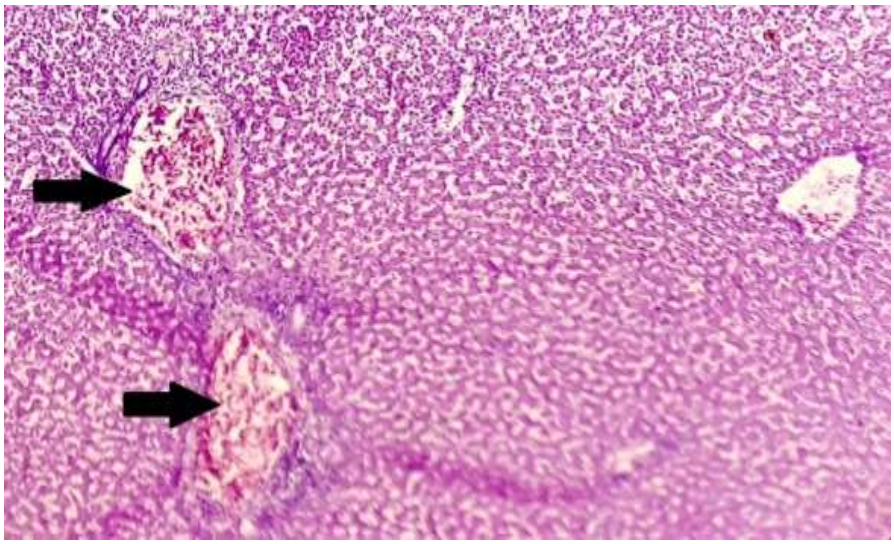

**Plate 5.** 167mg/L intake showing congested vascular channels. H&E X100.

and periportal mononuclear inflammatory infiltration as reported by Pacher et al., (2007). The degenerations observed in the kidneys and livers of the birds indicate that 167 and 334 mg/L L-arginine supplementation induced adverse effects on the organs as reported by Ichihara et al., (1999). NO is a powerful vasodilator and it blunts the expression of the tubuloglomerular feedback and acts as a vasoconstrictor; these result is expected (Dai et al., 2013). The result from this experiment shows that oral supplementation of high dosage of L-arginine had a negative effect on the structure of the kidney and liver of the Sasso birds given 50 and 100% L-arginine supplementation. Not ignoring its benefits, L-arginine could still produce its positive effects if used at a lower dosage of less than 50% supplementation level.

## Conclusion

One of the benefits of L-arginine is that it increases renal plasma flow (RPF) and glomerular filtration rate (GFR). However, from this study, high dosage of oral supplement can lead to the over-expression of nitric oxide in the organs causing a negative effect on the microscopic

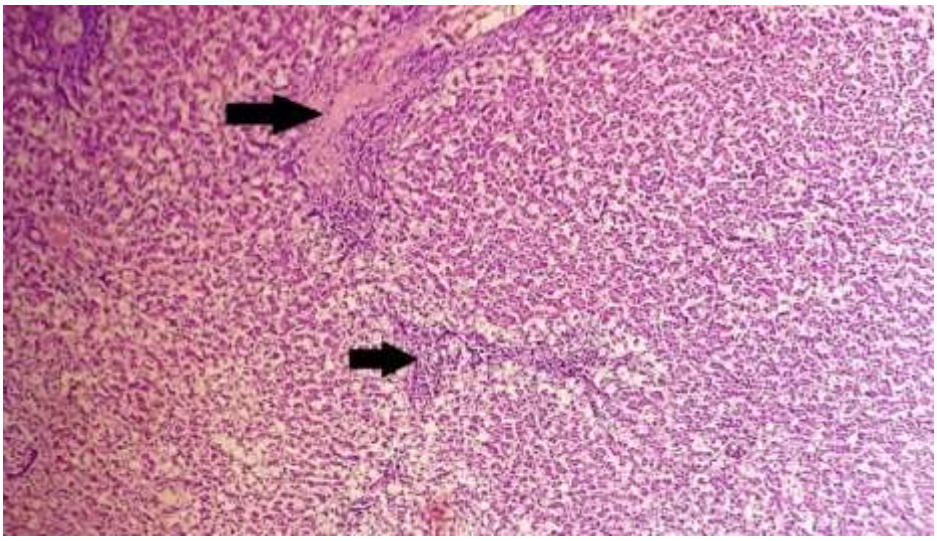

**Plate 6.** The mononuclear inflammatory infiltration of the portal tract and perivascular inflammation with 334 mg/L intake, H&E X100.

structure of the kidney and liver of the Sasso chickens. Based on the finding from this experiment, further research should be done with lesser dosage less than 50% supplementation level of L-arginine supplement on the Sasso chicken to maximize the benefits such as reduction of total body fat deposit without any negative form of alteration in the structure of the organs.

## CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

## ACKNOWLEDGEMENT

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### REFERENCES

Al-Daraji HJ, Al-Mashadani AA, Al-Hayani WK, Al Hassani AS, Mirza HA (2011). Influence of in ovo injection of L-arginine on productiveand physiological performance of quails. Research Opinion on Animal Veterinary Science 7:463-467.

Atakisi O, Atakisi E, Kart A (2009). Effects of dietary zinc and L-arginine supplementation on total antioxidants capacity: lipid peroxidation: nitric oxide, egg weight and blood biochemical values in Japanese quails. Biological Trace Element Research 132(1-3):136-143.

Dai Z, Wu Z, Yang Y, Wang J, Satterfield M (2013). Nitric oxide and energy metabolism in mammals. Biofactors, 39(4):383-391.

Hyun-Seek O, Se KO, Jum SL, Chungan W, Sung-Joon L (2017). Effects of L-arginine on growth and insulin like growth factor 1. Food Science and Biotechnology 26(6):1744-1754.

Ichihara A, inscho EW, Imig JD, Navar LG (1999) Neuronal nitric oxide synthasecontributes tobiphasic autoregulatory response during enhanced TGF activity. American Journal of Physiology (277):113-120.

Jeffery AK, John W, Daniel C, Yong YL, Sunni H (2014). Severe pulmonary embolism decrease plasma l-arginine. European Respiratory Journal (43):906-909.

Johnson OW (1979). Urinary organs. In: Form and Function in Birds, edited by King, A.S. and J. McLelland, London: Academic Press 1:183-235.

Kang K, Shu XL, Zhong JX, Yu TT, Lei T (2014). Effect of L-arginine on immune function: a meta-analysis. Asia Pacific Journal of Clinical Nutrition, 23(3):351-359.

Melik Z, Zaletel P, Virtic T (2016). L-arginine as dietary supplement for improving microvascular function. Clinical Hemorheology and Microcirculation 65(3):1-13.

Pacher P, Beckman J, Liaudet L (2007). Nitric oxide and peroxynitrite in health and disease. Physiology Review 2007(87):315-424.

Tan J, Lu S, Guo Y (2014). Dietary l-arginine supplementation attenuates lipopolysaccharide-induced inflammatory response in broiler chickens. British Journal of Nutrition 111(8):1394-1404. ISSN: 0007-1145. DOI: 10.1017/s0007114513003863

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

Tong BC, Barbul A (2004). Cellular and physiological effects of arginine. Mini Review on Medical Chemistry 48):823-832.

Trauner MI, Boyer JL (2003). Bile salt transporters: molecular characterization, function, and regulation. Physiology Review 83(2):633-671.

Trauner M (2003). When bile ducts say NO: the good, the bad, and the ugly. Gastroenterology 124:847-851.

Wideman RF (2001). Pathophysiology of heart/lung disorders: pulmonary hypertension syndrome in broiler chickens. World's Poultry Science Journal 57:289 -307.

Zhou HN, Deeb CM, Evock-Clover CM, Lamont SJ (2006). Genome-wide linkage analysis to identify chromosomal regions affecting phenotypic traits in the chicken. II. Body composition. Poultry Science 85:1712-1721.