NSAP 47th Annual Conference (JOS 2022) CONFERENCE PROCEEDINGS
THEME: SECURING ANIMAL AGRICULTURE AMIDST GLOBAL CHALLENGES

ANTIOXIDANT STATUS AND SERUM BIOCHEMICAL CHARACTERISTICS OF BROILER FINISHER BIRDS FED STAR FRUIT (*AVERRHOA CARAMBOLA)* EXTRACT

*****Ikeh N. E, Anizoba N.W, [+]Chinwendu, J. C, Ogwuegbu, M. C, Amaefule, B. C, Ndofor-Foleng, H. M, and Machebe, N. S.
Department of Animal Science, University of Nigeria, Nsukka
[+]Department of Animal Science, University of Port-Harcourt, Rivers State
*Corresponding Author: nnanna.ikeh.pg80080@unn.edu.ng; +2347033085209

ABSTRACT

A total of one hundred and twenty Arbo Acre broiler birds were used to evaluate the antioxidant status and serum biochemical characteristics of broiler finisher birds fed star fruit extract. The study lasted for a period of four weeks and the the design adopted was a completely randomized design (CRD) with four treatments having 30 birds per treatment. The star fruit extract was administered at 0.2%, 0.4%, 0.6% and 0% of the water given to T1, T2, T3 and T4 respectively. Feed and water were supplied ad libitum throughout the study period. The result obtained showed that at 0.2% star fruit extract had an antioxidant effect (P<0.05) on the broiler finisher birds as shown by the reduced MDA values compared to the control group while at a higher level (0.6%) the star fruit extract reduced SOD and GSH-RD values and increased the MDA values and had a probable harmful effects on the liver cells as shown by the increased (P<0.05) ALP levels in the blood. Also, the catalase, TP, Albumin, Globulin, AST and ALT values obtained showed that birds administered star fruit extract were not significantly different (P > 0.05) from those of the control group. It could therefore be concluded that lower levels of start fruit can be used as a potential antioxidant in broiler production to ameliorate stress conditions.

Keywords: broilers, star fruit, serum biochemistry, antioxidant status, stress

INTRODUCTION

Oxidative stress caused by excessive levels of reactive oxygen species (ROS) that are induced under stressful environmental conditions especially in the tropics such as heat exposure is regarded as one of the major factors negatively affecting performance of birds in the concentrated poultry industry (Lin *et al*., 2006; Mujahid *et al*., 2007). Due to the high incidence of heat stress and its economic consequences, supplementation of synthetic antioxidants (e.g., α-tocopheryl acetate or butylated hydroxytoluene) to mitigate the oxidative stress has become a common practice in the poultry industry. Plants and their bioactive derivatives such as extracts, essential oils, and secondary metabolites have recently attracted a lot of research attention for the development of novel additives for animal nutrition. This field of research is driven by both the consumers' demand for safer foods from healthier animals and use of plant extracts as natural antioxidants has gained increasing interest because of the global trend of restriction in use of synthetic substances (Ahn *et al*., 2002). Anti-oxidative properties of plants are attributed to compounds such as ascorbic acid, α-tocopherol, β-carotene, various flavonoids, and other phenolic compounds (Pennington and Fisher, 2009).Wang *et al*. (2008) reported that dietary supplementation of a grape seed proanthocyanidin extract as natural antioxidant improved the performance of broiler chickens and remedied the clinical symptoms caused by the oxidative stress of *Eimeria tenella* infection. The star fruit (*averrhoa carambola*) tree is a small, bushy evergreen tree that grows very well under hot, humid, tropical conditions. Star fruit contains good quantities of vitamin-C and is rich in antioxidant polyphenolic flavonoids such as quercetin, epicatechin, and gallic acid (Vijayalakshmi and Brindha, 2017). Altogether, these compounds help protect from deleterious effects of oxygen-derived free radicals. Therefore, feeding star fruit extract to broiler birds could help ameliorate the effects of heat stress during

production, hence, the need to evaluate the antioxidant status and lipid profile characteristics of broiler birds.

MATERIALS AND METHODS

The research work was conducted in the Poultry Teaching and Research Farm, University of Nigeria, Nsukka. Freshly harvested star fruit was thoroughly washed with salt to kill off any microbes and remove dirt, squashed and sieved to extract the juice. The star fruit extract was then collected with sterilized and calibrated volumetric flasks. The star fruit extract was administered to the birds by water immediately after extraction to prevent contamination or deterioration. Hundred and twenty four week old Arbo-Acre broiler birds were randomly allocated to four treatment groups having thirty birds per treatment. The treatments contained 0.2% (T1), 0.4 % (T2), 0.6 % (T3) and 0% (T4) of star fruit extract in the water given. Each treatment had five replicates with six birds per replicate and reared under the same environment where the commercial finisher feed (Hybrid Feeds) and water were fed *ad libitum*. After four weeks of the trial, three birds from each treatment were randomly selected and 3 mls of blood samples collected from the wing web vein for the determination of the anti-oxidative status and serum biochemical characteristics of the birds. The model is;

$$X_{ij} = \mu + T_i + \sum_{ij}$$

Where; X_{ij} = individual observation, μ = overall population mean, T_i = treatment effect, $\sum_{ij}$ = experimental error. The significant differences among the treatment means were separated using Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Table 1 shows the effect of star fruit extract on the antioxidant status of broiler finisher birds fed with the extract. The result of MDA obtained shows that birds administered 0.2% star fruit extract were significantly different ($P < 0.05$) from other treatment groups. The results of catalase showed no significant differences ($P > 0.05$) among treatment groups but that of GSH-RD and SOD showed that birds fed T4 were similar to those of T1 but significantly higher ($P \leq 0.05$) than birds on the other treatment. MDA which is a measure of lipid peroxidation (Jena *et al*, 2013) showed an increasing trend of lipid peroxidation with increasing levels of the extract. This increased level of lipid peroxidation could be as a result of the anti-nutritional effect of phytochemical component of the extract such as tannins, phytate and alkaloids (Vijayalakshmi and Brindha, 2017). The increased level of lipid peroxidation could also have been as a result of short period of administration because better antioxidant activity of the extract was recorded after eight weeks of administration (Jena *et al*, 2013). There was also a marked reduction in the antioxidant enzymes of GSH-RD and SOD in the system as the extract increased. This reduced antioxidant activity could be as a result of the proliferation of Reactive Oxygen Species (ROS) in the course of increased lipid peroxidation in the system as shown in the MDA results obtained (Jena *et al*, 2013).

Table 1: Effect of Star Fruit extract on Antioxidant Status of Broiler Finisher Birds

Parameters	T1 (0.2%)	T2 (0.4%)	T3 (0.6%)	T4 (0%)	SEM	P. value
MDA (TBARS)	0.25^{b}	0.34^{a}	0.37^{a}	0.31^{a}	0.01	0.02*
CAT (KU/l)	87.65	106.33	79.50	112.78	7.43	0.37^{NS}
GSH-RD (Mol/ml)	10.15^{a}	9.27^{ab}	6.84^{b}	11.25^{a}	0.67	0.01**
SOD (u/ml)	1.25^{a}	0.55^{b}	0.27^{b}	1.44^{a}	0.16	0.01**

^{abcd}: Means in the same row with different superscripts are significantly different ($P < 0.05$).
MDA: Serum Malondialdehyde level, CAT: Serum Catalase activity, GSH-RD: Reduced Glutathione, SOD: Superoxide Dismutase activity.

The results of the serum biochemical characteristics of the finisher broiler birds are shown on Table 2. The results of TP, Albumin, Globulin, AST and ALT obtained shows that birds administered star fruit

extract were not significantly different (P > 0.05) from those of the control group though AST level increased numerically with increasing level of the star fruit extract. The values obtained were within the normal range for finisher broilers (Okwesili *et al.*, 2021). ALP values for birds administered 0.6% star fruit extract was significantly higher (P < 0.05) than the other treatment groups. The liver chemistry tests of AST, ALT and ALP are measures of liver function of animals. High levels above normal ranges are indications of liver damage (Teh *et al.*, 2010). The high values of ALP on administration of the extract suggests that some form of liver cell damage occurred from the administration of high levels of the extract and this could be as a result of the anti-nutritional effect of the phytochemical component of the extract (Vijayalakshmi and Brindha, 2017). This coincides with the findings of Teh *et al.* (2010) who observed that oral administration of star fruit extract inhibited acetylcholinesterase activity which is also a form of liver damage assessment. Khoo (2010) also observed that administration of star fruit after three hours of storage led to a significant level of liver damage.

Table 2: Effect of Star Fruit Extract on Serum Biochemical Characteristics of Finisher Broiler birds

Parameters	T1 (0.2%)	T2 (0.4%)	T3 (0.6%)	T4 (0%)	SEM	P. value
AST (g/dl)	188.97	201.00	213.28	204.30	12.294	0.92 ^{NS}
ALT (g/dl)	10.48	9.34	7.28	8.51	1.081	0.80 ^{NS}
ALP (mg/dl)	48.27^{b}	47.92^{b}	72.42^{a}	38.91^{b}	414.531	0.01**
TP (g/dl)	2.85	2.80	2.60	3.03	0.099	0.55 ^{NS}
Albumin (g/dl)	1.63	1.48	1.71	1.63	0.049	0.44 ^{NS}
Globulin (g/dl)	1.22	1.12	0.89	1.40	0.086	0.17 ^{NS}

^{abcd}: Means in the same row with different superscripts are significantly different (P < 0.05).
AST: aspartate transaminase, ALT: alanine transaminase, ALP: Alkaline phosphatase, TP: total protein.

CONCLUSION AND RECOMMENDATION

In conclusion, high doses of star fruit extract despite its high vitamin C content does not mitigate the harmful effects of oxidative stress in the boiler finisher birds due to the health hazards associated with it such as toxicity and damage to liver tissues, although further research is needed for validation. However, small quantities of the extract (0.2%) proved effective in minimizing lipid peroxidation. Care should be taken in the administration of star fruit extract as an antioxidant as high levels of the extract could be detrimental. Smaller doses however can be administered over a longer period of time to attenuate lipid peroxidation in broiler finisher birds.

REFERENCES

Ahn H. J., Kim, J. H., Jo, C., Kim, M. J. and Byun, M. W. (2002). Comparison of irradiated phytic acid and other antioxidants for antioxidant activity. *Food Chemistry 88(2), 173-178*

Duncan D.B (1995) Multiple Range Test, *Biometrics*, **11**: 1-4.

Jena, B.S., Negi, P.S. and Jayaprakasha, G. K. (2013). Antioxidant and antimutagenic activities of pomegranate peel extracts. *Food Chemistry 80(3).*

Khoo, Z. Y., Teh, C. C., Rao, N. K. and Chin, J. H. (2010). Evaluation of the toxic effect of star fruit on serum biochemical parameters in rats. Faculty of Pharmaceutical Sciences, UCSI University, Cheras, 56000, Kuala Lumpur, Malaysia.

Lin, H., Jiao H. C., Buyse, J. and Decuypere, E. (2006). Strategies for preventing heat stress in poultry. *World Poultry Science Journal 62(1), 71-86*

Mujahid, A., Pumford, N. R., Bottje W., Nakagawa K., Miyazawa T., Akiba Y. and Toyomizu M. (2007). Mitochondrial oxidative damage in chicken skeletal muscle induced by acute heat stress. *The Journal of Poultry Science 44(4), 439-445*

Okwesili O.R., Ikele C.M., Ikeh N.E., Anizoba N.W. and Osita C.O. (2021). Oral administration of *Vernonia amygdalina* leaf extract: implications on performance of broiler finishers raised in derived savannah. *Agro Science*, **20 (2),** 86-91. DOI: https://dx.doi.org/10.4314/as.v20i2.14

Pennington, J. A. T. and Fisher, R. A. (2009). Classification of fruits and vegetables. *Journal of food composition and analysis 22, S23-S31.*

Teh, C.C., Khoo, Z.Y., Khursiah, F., Rao, N.K. and Chin, J.H. (2010). Acetylcholinesterase inhibitory activity of star fruit and its effect on serum lipid profiles in rats. Faculty of Pharmaceutical Sciences, UCSI University, No. 1, Jalan Menara Gading, UCSI Heights, 56000. Kuala Lumpur, Malaysia.

Vijayalakshmi and Brindha, 2017

Vijayalakshmi, C. and Brindha, D. (2017). Phytochemical Screening and Total Antioxidant Activity of *Averrhoa Carambola* Hydroethanolic Fruit Extract. *World Journal of Pharmacy and Pharmaceutical Sciences.* 6 (5), 935-944. Doi: 10.20959/Wjpps20175-9090

Wang, X., Tong, H., Chen, F., and Gangemi, J. D. (2008). Chemical characterization and antioxidant evaluation of muscadine grape pomace extract. *Food Chemistry 123 (4), 1156-1162*.