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Lycopene and African walnut extract improved seminal antioxidative enzymes and serum biochemical Indices of heat-stressed cockerels

O.A. Ojo [a], K. Okukpe [b], O.A. Jimoh [c], A.O. Akintunde [d], U.U. Carols [e]

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Keywords: Lycopene, African walnut, Cockerels, Seminal plasma, Heat stress.

Application

Herbal supplementation during climatic stress could alleviate neuronal cell damage, prevent tissue retention of synthetic pharmaceuticals and enhance better health status of animal product consumers.

Background

Incidence of global warming has adversely influenced animal health and reproductive performance more prominently under tropical climate. According to Hassen et al (2022), the recent ban of synthetic pharmaceuticals has necessitated the use of herbal supplements, which are cheap and naturally available. Shafe et al. (2024). reported that lycopene and African walnut leaf extract (AWLE) have been proven to contain bioactive components with antioxidant capability needed to improve seminal plasma biochemical indices of cockerels under tropical environment.

Objective

This study was conducted to determine the effect of lycopene and AWLE on seminal plasma biochemistry indices heat-stressed cockerels.

Materials and methods

This research was approved by ethical approval committee of the Kwara State University, Nigeria and carried out at the Poultry Unit of the Teaching and Research Farm, Kwara State University, Malete. Lycopene extraction was carried out according to Roldán-Gutiérrez and de Castro (2007) procedure.

30-weeks old cockerels ($n = 54$) were used for this experiment (10 weeks) with treatments stated as follows; **Group 1** – 250 ml of water, no inclusion (control), **Group 2** – 7.5 ml of lycopene/250 ml of water, **Group 3** – 15 ml of lycopene/250 ml of water, **Group 4** – 7.5 ml of AWLE/250 ml of water, **Group 5** – 15 ml of AWLE/250 ml of water, **Group 6** – 7.5 ml of lycopene + 7.5 ml of African walnut leaf extract/250 ml of water, **Group 7** – 15 ml of lycopene + 15 ml of leaf extract/250 ml of water, **Group 8** – Vitamin C 0.1g/250 ml of water, **Group 9** – Cold temperature and 250 mls water (20 °C). Semen was collected using Bakst and Long (2010) methodology. All data collected were subjected to Analysis of Variance using Statistical Analysis System software. Means were separated using Duncan Multiple Range Test.

Results

The table of result is as shown in Table 1. Observation showed that cockerels under group 5 experienced a significantly depressed Malondialdehyde (0.61 ± 0.09 U/mg), while showing significant ($P < 0.05$) elevation in seminal catalase value (741.27 ± 21.01 U/mg). It was also noted total protein value (9.75 ± 0.23 mg/dl) was significantly ($P < 0.05$) increased under group 9, which is statistically similar with values recorded for groups 4 and 8. According to Asfandiyar et al. (2024), malondialdehyde is a biomarker of oxidative stress (OS), which leads to molecular damage and lipid peroxidation. Catalase protects cells from oxidative damage caused by reactive oxygen species (ROS). A reduction in MDA value and an increase in catalase under group 5 could be due to the influence of bioactive components present in AWLE. Seminal plasma proteins (SPP) enhance sperm protection, transport and fertility via improved capacitation and acrosome reaction.

Table 1. Effect of lycopene and AWLE on seminal plasma biochemistry of heat stressed cockerels.

TREATMENT	T – CHOL (mg/dl)	TOTAL P (mg/dl)	SOD U/mg	CAT U/mg	ARGIN ng/nl	GPx U/mg
1	208.67 ± 92.78	8.67 ± 0.06^{d}	203.53 ± 44.07	624.98 ± 393.98^{ab}	83.39 ± 4.02	478.67 ± 329.58
2	182.66 ± 41.38	8.78 ± 0.41^{cd}	195.93 ± 2.92	357.64 ± 43.89^{ab}	91.44 ± 36.89	768.54 ± 254.71

TREATMENT	T – CHOL (mg/dl)	TOTAL P (mg/dl)	SOD U/mg	CAT U/mg	ARGIN ng/nl	GPx U/mg
3	101.16 ± 10.36	9.51 ± 0.08^{abc}	228.10 ± 124.89	276.62 ± 118.42^{ab}	82.52 ± 20.44	800.36 ± 214.55
4	137.58 ± 114.23	9.68 ± 0.62^{ab}	181.10 ± 30.79	334.58 ± 140.60^{ab}	102.20 ± 19.26	699.34 ± 97.63
5	143.35 ± 97.08	8.85 ± 1.09^{cd}	187.05 ± 34.22	741.27 ± 450.70^{a}	113.61 ± 28.65	794.16 ± 303.95
6	224.56 ± 210.92	8.88 ± 0.26^{cd}	171.54 ± 23.78	149.11 ± 11.91^{b}	108.72 ± 80.95	842.67 ± 800.88
7	194.22 ± 42.33	8.98 ± 0.35^{bcd}	190.69 ± 41.57	673.17 ± 12.46^{ab}	97.30 ± 9.33	696.38 ± 87.57
8	186.99 ± 74.46	9.26 ± 0.32^{abcd}	172.62 ± 19.26	442.65 ± 235.84^{ab}	135.35 ± 11.14	474.34 ± 220.71
9	43.93 ± 4.68	9.75 ± 3.23^{a}	150.27 ± 116.32	170.94 ± 12.88^{b}	131.65 ± 10.34	85.47 ± 15.67

T-CHOl = total cholesterol, Total P = total protein, SOD = Superoxide dismutase, CAT = Catalase, ARGIN = arginase, GPx = Glutathione peroxidase, MDA = Lipid peroxidation, TAC = total antioxidant capacity.; T1 = 0 ml of extract/250 ml of water, T2 = 7.5 ml of lycopene/250 ml of water, T3 = 15 ml of lycopene/250 ml of water, T4 = 7.5 ml in full then of AWLE 250 ml of water, T5 = 15 ml of AWLE/250 ml of water, T6 = 7.5 ml of lycopene + 7.5 ml of AWLE/250 ml of water, T7 = 15 ml of lycopene + 15 ml of AWLE/250 ml of water, T8 = Vitamin C 0.1 g per 250 ml of water, T9 = Cold temperature + Cold water (20 °C); Means within the column with different superscript ^{abcd} are significantly different ($p < 0.05$).

In conclusion, oral administration of 15 ml of AWLE/250 ml of water (Group 5) while maintaining a controlled thermoneutral zone temperature for cockerels (18–22 °C) might improve reproductive performance under heat-stress condition.

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