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IMPACT OF DIETARY OLEUROPEIN SUPPLEMENTATION ON PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE OF GROWING BANDARAH COCKERELS

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ABSTRACT: The objective of the study was to examine the effect of varying levels of oleuropein supplementation on productive performance and physiological parameters of Bandarah cockerels. A total of one hundred (28-day-old) Bandarah cockerels were weighed individually and randomly assigned to four treatment groups. From 4 to 16 weeks of age, five replicates (5 cockerels per rep.) were used to represent each treatment group. A basal diet group 1without any supplements (control), while groups 2, 3, and 4 received diets supplemented with 50, 100, and 150 mg of oleuropein/kg feed, respectively. Body weight and body weight gain were increased (p<0.001) when used 100 and 150 mg oleuropein/kg feed compared to the other treatments. Feed consumption was not impacted, but feed conversion ratio enhanced overall period when oleuropein was added. Carcass characteristics had not affected by oleuropein addition while, bacterial count in the intestine were reduced by increasing oleuropein levels. The inclusion of oleuropein in the diet of cockerels reduced (p<0.001) level of LDL and total cholesterol, activity of AST,ALT, and ALP enzymes, while, increased HDL level compared to the control diet. Adding oleuropein at varying concentrations Heterophils and the H/L ratio dropped, whereas WBC and lymphocytes increased. The immunoglobulin (IgG and IgM) levels improved in reaction to oleuropein treatments; the group fed with 150 mg/kg diet had the highest levels. Total plasma antioxidant capacity (TAC) and superoxide dismutase (SOD) activities were increased by increasing oleuropein levels, while malondialdehyde (MDA) was significantly decreased compared with control group. Oleuropein supplementation at all levels showed improved economic efficiency compared with control group. The relative economic efficiency of a diet containing 100 mg oleuropein/kg feed increased by approximately 28.4% than the control group. In conclusion, oleuropein supplementation at a dosage of up to 150 mg/kg feed enhanced growth performance, intestinal microbial count, physiological parameters and anti-oxidative status of Bandarah cockerels during the growth period and the best value was 100 mg/kg.

Keywords: Oleuropein, performance, physiological parameters, antioxidant

INTRODUCTION

There is a growing demand for incorporating phytochemicals into poultry diets as natural supplements to enhance health and performance. Animals have been shown to benefit from phytochemicals such as polyphenolic compounds' antioxidant properties. Improving performance and quality of production (Lee et al., 2013). Polyphenolic phytochemical have a variety of positive physiological benefits in both people and animals, such as anti-inflammatory, anti-oxidative, pro-gut health, and metabolic responses which naturally occurring metabolites found in plants have attracted more and more attention (Starcevic et al., 2015and Shimao et al., 2019).

Olive leaf (Olea europaea), as byproducts amounts to 330, 000 tons annually around the world is considered cheap and an abundant source of phenolic compounds, it is widely used in breeding fields in animals and functional foods. The increasingly growing demand for healthy husbandry using natural available poly-phenols. Olive leaves are higher in oleuropein and other polyphenols which contain 1–14% oleuropein while olive oil only has 0.005–0.12% (Achat et al., 2012). The main component of olive polyphenols is oleuropein, a non-toxic secoiridoid. The amount of this compound in olives and their oil varies depending on the type of olives, how they are made, and how they are stored (Le Toutour and Guedon 1992). Oleuropein comes in glycosylated and non-glycosylated forms, which change its solubility, and it has important health promoting qualities, such as antioxidant activity and cardiovascular disease prevention (Ryan et al., 2002). Recently, oleuropein has advantageous pharmacological properties, including immuno-stimulant, hypo-tensive, cardio protective, plasmolytic, anti-inflammatory and antioxidant actions (hassen et al., 2015). The European Food Safety Authority has confirmed the safety of olive leaf extract as a sensory additive in feed for all animal species (Authority EFS 2007). In a different study, quail's performance and the quality of their breast muscle lipid were enhanced by dietary oleuropein supplementation (400ppm) (Bahsi et al., 2016). According to El-Damrawy et al. (2013) adding 2% olive leaf powder to Mandarah chick's diet enhanced their body weight, feed conversion, and the majority of their blood biochemical and immunological characteristics. Also, oleuropein is used as a phytogenic additive in chickens feed because of its many anticipated positive effects on performance, lipid profile, immunological function and anti-oxidative status (Ahmed et al., 2017). Similarly, broiler growth performance and caecal microbiota populations were greatly enhanced by feeding them a diet enriched with 600 mg kg-1 oleuropein (Erener et al., 2020). Furthermore, adding 300 and 600 ppm of olive leaf extract to growing Japanese quails improved their intestinal microbiota, blood biochemical and immunological indices, antioxidant capacity, and productivity (Abdel-Kader et al., 2024).

In the light of the potential benefits of oleuropein, the purpose of the current study was to assess how various oleuropein levels affected the physiological and productive performance of growing Bandarah cockerels.

MATERIALS AND METHODS

The current study was conducted at El-Sabahia Poultry Research Station, Alexandria Governorate belonging to Animal Production Research Institute, Agriculture Research Center. The experiment was conducted from 19 March to 10 June 2020 to investigate the influence of dietary supplementation with oleuropein on productive, physiological and immunological parameters in Bandarah cockerels during growth period.

Birds, management and experimental design:

A total of one hundred (28-day-old) Bandarah cockerels were weighed individually and randomly assigned to four treatment groups. Each treatment group was represented by five replicates (5 cockerels / rep.) from4 – 16 wk of age. Group 1 (control) fed basal diet without any supplementation, group 2, 3 and 4 were fed diets supplemented with 50, 100 and 150 mg oleuropein/kg feed, respectively. Oleuropein (98%) was purchased from Sigma-Aldrich in powder form.The experimental diets' composition and calculated analyses are shown in Table 1. All of the birds were housed in rearing cages with comparable management conditions. Feed and water were provided ad libitum.

Experimental Measurements:

All birds were individually weighed (g) and recorded every 2 weeks. During these periods, mortality and feed consumption were recorded. Body weight gain and feed conversion ratio (feed/g gain) were calculated.

Carcass characteristics: Ten cockerels from each treatment were taken at random and slaughtered for carcass evaluation at 16 weeks of age. The carcass was eviscerated, liver, gizzard, heart, and spleen were weighed and expressed as a percentage of live body weight.

Blood analyses: Two blood samples (3 ml, each) were taken from the brachial vein of five birds /treatment at the end of the experiment. One sample was placed into a heparinized tube to separate plasma and the other was placed into an un-heparinized tube. White blood cell counts (WBCs) and their fractions (lymphocytes % and heterophils %) were determined using the fresh blood samples. The plasma was separated right away using centrifugation for ten minutes at 3200 rpm. Plasma total cholesterol concentration (mg/dl), high-density lipoprotein (HDL), low-density lipoprotein (LDL) cholesterol concentrations (mg/dl), alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT) activity, total antioxidant capacity (TAC), superoxide dismutase (SOD), and Malondialdehyde (MDA) were measured spectrophotometrically using commercial Kits. Immunoglobulin M (IgM) and G (IgG) titres were determined using ELISA kits.

Microbiological study: the American Public Health Association's guidelines for determining intestinal aerobic, anaerobic and total coliform counts were followed (1985).

Economic efficiency: Each treatment's total body weight cost and feed cost (L.E.) were determined using the current local market price for the ingredients and the birds' body weight.

The following formulas were used to determine economic efficiency (EE) and relative economic efficiency (REE):

EE = Net revenue / Total cost X100.

REE, assuming control treatment = 100 %.

Statistical analysis:

Data were analyzed by the analysis of variance according to SPSS (2008) and significant differences among means were detected by the Duncan's Multiple Range Test (Duncan, 1955).The following model was used : $Y_{ij} = \mu + T_i + e_{iJ}$ where, Y_{ij} = an observation, μ = overall mean, T_i = Effect of treatment (1, 2 , 3 , 4) and e_{iJ} = Random error

RESULTS AND DISCUSSION

Growth performance

The results of the effect of dietary oleuropein supplementation on body weight and body weight gain of Bandarah cockerels were shown in Table 2. At the overall period studied, body weight and body weight gain were significantly increased when used 100 and 150 mg oleuropein/kg feed compared to the control, and the 100 mg oleuropein/kg diet group recorded the highest value. These results agree with those of El-Damrawy et al. (2013) and Jabri et al. (2017) who found that broiler performance improved with dietary oleuropein supplementation. Similarly, adding oleuropein to the diet enhanced the growth performance of quail (Bahsi et al., 2016) and laying hens (Cayan and Erener, 2015and Ahmed et al., 2017). Contrary to these reports, quail diets supplemented with oleuropein at increasing levels exerted 150 or 200 mg/kg did not promote growth (Sarica and Toptas, 2014).

According to Oke et al. (2017), broilers gave 15 ml/L of olive leaf extract showed noticeably higher final live body weight and body weight gain than those 10 ml, 5 ml, and control. Moreover, our findings in accordance with those of Erener et al. (2020), who reported that broiler fed a diet containing oleuropein extract at levels 150, 300 and 600 ppm/kg had higher daily body weight gain than the control.

Table 3 showed that there were no significant differences in the feed consumption of the groups given varying amount of oleuropein compared to the control group. Regarding feed conversion, results indicated that feed conversion were significantly ($p<0.001$) improved for all groups supplied with different levels of oleuropein(50, 100 and 150 mg/kg diet by 10.8, 15.1 and 15.3%, respectively) compared with control group. Our findings concurred with the research of Ahmed et al. (2017) who demonstrated that birds fed diets treated with oleuropein at 50, 100 and 150 mg/kg had the best feed conversion ratio when compared to the control. While, the groups that received varying dosages of oleuropein did not exhibit any discernible differences in feed intake when compared to the control group. The same results obtained when oil leaf extract was added to the quail's diet at 300 and 600 ppm (Abdel-Kader et al., 2024).It is clear for the improvement of the current results for the growth performance of chicks may be attributed to improvements in food absorption, digestive enzyme activity, and caecal microbiota (Toghyani et al., 2011andZeng et al., 2015), as well as in blood metabolites (Jemai et al., 2008).In the same line, Mahasneh et al. (2024) found that, oil leaf or its derivatives can improve growth and feed efficacy of broiler chickens by improving the digestibility of nutrients influencing the release of digestive enzymes. Additionally, they can enhance microbial diversity and intestinal health.

Carcass traits

For carcass characteristics, there were no significant ($p>0.05$) differences between the control and oleuropein treatments examined (Table 4). The same finding obtained by Shafey et al. (2013), Jabri et al. (2017), Ait-Kaki et al. (2018) and Erener et al. (2020 and 2023) who found no significant impact of adding olive leaves and/or olive leaf extract to the diet and/or drinking water on certain carcass characteristics in broiler chickens.

Microbiological parameter

Table 5 showed that in comparison to the control group, the number of aerobic, anaerobic, and coliform bacteria in the intestines of Bandarah cockerels dropped in all oleuropein-supplemented groups as oleuropein levels rose. These outcomes aligned with Ereneret al. (2020) findingswho observed that olive leaf extract supplementation improved caecal microflora while the caecal E. coli content decreased in broiler chickens. In the same way, adding olive leaf extract to broiler diets at level 0.3% resulted in a reduction in E.coli (Xie et al., 2022). Oleuropein and hydroxytyrosol support the alteration of gut microbiota composition and improve gut integrity (Sarica and Urkmez 2016). One potential explanation for the suppression of E. coli growth is that polyphenols may attach to bacterial cell membranes, disrupting their function (Lin et al., 2005and Cardona et al., 2013). In summary, the supplementation of polyphenols in poultry can influence the species and concentrations of caecal microbiota, as demonstrated in our research.

Some blood constituents:

From Table 6 In summary, oleuropein added to cockerel feed dramatically reduced the concentrations of both total and LDL cholesterol in treated groups as compared to the control group; nevertheless, the same effect was observed at high dosages of oleuropein (100 and 150 mg). Also, dietary oleuropein caused a significant increase in the benefit part of cholesterol (HDL) concentration than the control group. In the same line, Parasei (2014) stated that feeding broiler chickens with oil leaf powder resulted in significant decreasing on plasma levels of cholesterol, triglyceride, LDL cholesterol and liver enzymes. Furthermore, Quail fed a meal supplemented with 200 mg/kg-1 oleuropein showed lower levels of blood total and LDL cholesterol, according to Sarica and Toptas (2014).Krzeminski et al. (2003) suggested that the hypocholesteroleic property of oil leaf may be due to either a decrease in the liver's synthesis of the cholesterol or a decrease in its intestinal absorption. Oil leaf extract also promotes the biliary secretion of cholesterol and its excretion in feces (Prasad and Kalra 1993). Oleuropein's ability to inhibit 3-hydroxy-3-methyglutaryl coenzyme A, an enzyme crucial to the synthesis of cholesterol, and to prevent LDL oxidation may be linked to its hypocholesterolemia effect (Patrick and Uzick, 2001).

As indicated in Table 6, supplementing the cockerels' diet with oleuropein reduced their serum transaminases (AST and ALT) and alkaline phosphatase (ALP) activity compared to the control group. Liver damage is identified by elevated serum ALT, AST and ALP levels (Ozaki et al., 1995).The hepatoprotective effect of oleuropein in the present study are in agreement with findings by Agah et al. (2019) who found that adding 400 mg/kg of oil leaf to heat-stressed broiler diets reduced the activity of ALT and ALP .On the other hand, Ahmed et al. (2017) found that serum AST and ALT activity were not affected by using dietary oleuropein at levels of 50, 100 and 150 mg/kg for laying hens. The phenolic structure of oleuropein helps to prevent liver damage caused by free radicals, as evidenced by the improvement in liver enzyme results observed thus far. Also the hepatoprotective effect of oleuropein appears to be linked to its antioxidant properties.

Immune and antioxidant responses:

Table 7 demonstrated that the addition of oleuropein had a substantial impact on the WBC count, lymphocyte (L) percentage, heterophils (H) percentage, H/L ratio, and serum immunoglobulin concentrations (IgG, IgM). The WBC count, lymphocyte and IgG and IgM concentrations were all significantly elevated by the addition of oleuropein at all levels used in comparison to the control group; the group that was given 150 mg of oleuropein/kg feed had the highest value. The number of heterophils and the H/L ratio were significantly lower in cockerels fed a diet containing oleuropein than in the control group. However, according to Koncicki and Krasnodebska-Depta (2005), the H/L ratio is a measure of the immunological response. Therefore, a decrease in the H/L ratio in the current study improved the immunological response.We discovered that adding olive leaf powder to broiler diets considerably boosted count WBC, heamaglutination inhibition (HI), and superoxide dismutase (SOD), while dramatically decreasing the H/L ratio. These results were in line with those of El-Damarawy et al. (2013).Also, Parasei et al. (2014) discovered that broiler chickens` immunity was improved by dietary supplementation with olive leaf powder. According to Ahmed et al. (2017), laying hens' immunoglobulin response was improved when oleuropein was added to their food at doses of 50, 100, and 150 ppm oleuropein/kg. Furthermore, adding 300 and 600 ppm of olive leaf extract increased the immune response (IgG, IgA and IgM) in growing Japanese quails (Abdel-Kader et al., 2024). The structure of oleuropein may be the cause of this improvement, since polyphenols have been demonstrated to influence chicken immune signaling pathways (Shin et al., 2011).

From Table 7, it could be summarised that adding oleuropein to Bandarah cockerels improved total antioxidant capacity (TAC), superoxide dismutase (SOD) and malondialdehyde (MDA) concentration. On the other hand, all doses of oleuropein supplementation increased plasma TAC and SOD activity relative to control, with the 150 mg/kg dose showing the largest increase. In contrast to the control group, plasma MDA levels dropped as dietary oleuropein levels rose. It seems that the decrease of MDA level using supplementary oleuropein is due to its antioxidant characteristic in reducing both reactive oxygen species (ROS) and lipid peroxidation (Visioli et al., 2002). Our results aligned with the findings of Ahmed et al. (2017), who found that laying chickens fed diets containing 50, 100 and 150 mg oleuropein/kg showed a significant decrease in MDA levels and a noticeable improvement in SOD and TAC levels. Moreover, Agah et al. (2019) reported that the chicks fed an olive leaf extract diet at 400 ppm had significantly lower levels of MDA than those receiving control and other treatments. Similar results were clarified by Xie et al. (2022) who found that antioxidant enzyme levels (T-AOC, T-SOD, GSH-PX and CAT) increased and MDA levels decreased when broiler chickens were fed a 0.3% olive leaf extract supplement in their basal diet. Additionally, the inclusion of olive leaf extract in the diet of growing Japanese quails at concentrations of 300 and 600 ppm demonstrated increased SOD and decreased MDA levels (Abdel-Kader et al., 2024). According to Silva et al. (2006) and Jemai et al.(2008), olive leaves and their extract contain a variety of phytochemicals that may be antioxidants. According to Hayes et al. (2011), the phenolic compounds found in olive leaf extract are thought to be free radical scavengers because they break the chain reaction of free radicals.

Table 8 demonstrated the economic efficiency of supplementation with oleuropein for Bandarah cockerels. Compared to the control group, oleuropein supplementation at all levels showed better economic efficiency. When compared to all treatments, the 100mg oleuropein/kg feed produced the best economic efficiency. In comparison to the control group, the relative economic efficiency of a diet containing 100 mg oleuropein /kg feed increased by approximately 28.4%.

CONCLUSION

The addition of oleuropein (50, 100 and 150 mg/kg) to cockerels’ feed boosted growth performance, intestinal bacterial count, lipids profile, antioxidant status and immune response with lower feed cost and higher economic efficiency, whereas 100 mg/kg was more effective than the others. The positive results obtained indicate that oleuropein is used as a natural additive in the feed of Bandarah cockerels during the growth period.

Table (1): Composition and calculated analysis of the basal experimental diets

Ingredients (%)	**Starter (4-8 wks)**	**Grower (8-16wks)**
Yellow corn	64.00	63.00
Soybean meal (44% CP)	32.10	17.60
Wheat bran	------	15.68
Dicalcium phosphate	1.80	1.25
Limestone	1.40	1.80
DL-Methionine	0.10	0.07
NaCl	0.30	0.30
Vit. and mineral (premix)*	0.30	0.30
Total	100	100
Calculated analysis**		
Crude protein (%)	19.56	15.56
ME (Kcal/kg diet)	2860	2707
C/P ratio	146.2	174
Crude fat (%)	2.69	3.01
Crude fiber (%)	3.65	4.34
Calcium (%)	1.03	0.97
Phosphorus available (%)	0.47	0.39
Methionine (%)	0.41	0.33
Methionine + Cysteine (%)	0.74	0.54
Lysine (%)	1.03	0.73
Arginine (%)	1.25	0.95

*Three kg of vitamin- mineral premix per ton of feed supplied each kg of diet with Vit. A 12000 IU; Vit. D3 2000 IU; Vit. E. 10mg; Vit. K3 2mg; Vit.B1 1mg; Vit. B2 4mg; Vit. B6 1.5 mg; Pantothenic acid 10mg; Vit.B12 0.01mg; Folic acid 1mg; Niacin 20mg; Biotin 0.05mg; Choline chloride (50% choline) 500 mg; Zn 55mg; Fe 30mg; I 1mg; Se 0.1mg; Mn 55mg; ethoxyquin 3000 mg.
**According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

Table (2): Effect of dietary oleuropein supplementation on body weight and body weight gain of Bandarah cockerels

Treatments	**Body weight (g)**				**Body weight gain (g)**			
	4 wks	**8 Wks**	**12 Wks**	**16 Wks**	**4-8 wks**	**8-12 wks**	**12-16 wks**	**4-16 wks**
Control	333.96	779.16	1240.12^{b}	1534.92^{c}	445.20	460.96^{b}	294.80^{b}	1200.96^{c}
Oleuropein 50	331.88	810.24	1304.08^{ab}	1618.24^{bc}	478.36	493.84^{ab}	314.16^{b}	1286.36^{bc}
Oleuropein100	338.08	831.24	1373.64^{a}	1769.64`^{a}	493.16	542.40^{a}	396.00^{a}	1431.56^{a}
Oleuropein150	333.28	779.16	1265.84^{b}	1709.60^{ab}	445.88	486.68^{ab}	443.76^{a}	1376.32^{ab}
SEM	4.47	9.86	15.64	23.02	7.76	9.99	12.87	21.47
P value	0.967	0.171	0.014	0.001	0.064	0.031	0.0001	0.0001

a, b, c Means in the same column with different superscripts are significantly different (P<0.05)
SEM: standard error of the mean.

Table (3): Effect of dietary oleuropein supplementation on feed consumption and feed conversion ratio of Bandarah cockerels.

Treatments	Feed consumption (g/chick)				Feed conversion ratio (g feed/g gain)			
	4-8 wks	8-12 wks	12-16 wks	4-16 wks	4-8 wks	8-12 wks	12-16 wks	4-16 wks
Control	1316.92	1623.80	2066.20^{a}	5006.92	2.96	3.53	7.33^{a}	4.18^{a}
Oleuropein 50	1207.44	1608.16	1975.20^{b}	4790.80	2.54	3.28	6.44^{ab}	3.73^{b}
Oleuropein100	1292.72	1698.60	2075.60^{a}	5066.92	2.64	3.14	5.28^{bc}	3.55^{b}
Oleuropein150	1222.12	1551.20	2091.20^{a}	4864.52	2.75	3.21	4.75^{c}	3.54^{b}
SEM	25.27	20.50	16.44	46.26	0.067	0.069	0.305	0.076
P value	0.365	0.072	0.039	0.122	0.132	0.208	0.003	0.001

a, b, c Means in the same column with different superscripts are significantly different ($P<0.05$)
SEM: standard error of the mean.

Table (4): Effect of dietary oleuropein supplementation onCarcassTraitsofBandarah cockerels.

Trait	Oleuropein levels, mg/kg diet				SEM	*P value*
	0	50	100	150		
Carcass %	67.62	67.21	69.17	69.25	0.397	0.137
Gizzard %	1.90	2.09	2.24	1.91	0.085	0.494
Liver %	1.96	2.24	1.93	2.04	0.060	0.296
Heart %	0.58	0.61	0.59	0.57	0.023	0.130
Spleen %	0.30	0.33	0.30	0.32	0.020	0.225
Intestinal %	3.35	3.33	3.18	2.97	0.232	0.466
Intestinal length (cm)	148.67	160.67	161.67	145.00	4.971	0.606
Adable %	4.42	4.96	4.89	4.52	0.103	0.157

Table (5): Effect of dietary oleuropein supplementation on aerobic, anaerobic and total coliform bacteria count in the intestine of Bandarah cockerels.

Trait	Oleuropein levels, mg/kg diet			
	0	50	100	150
Total aerobic	$17x10^{9}$	$14x 10^{8}$	$10x10^{8}$	$4x10^{8}$
Coliform Total	$40x10^{8}$	$25x10^{5}$	$16x10^{4}$	$11x10^{4}$
Anaerobic	$32x10^{3}$	$19x10^{2}$	$8x10^{2}$	$4x10^{2}$

Table (6): Effect of dietary oleuropein supplementation on selected biochemical blood constituent in Bandarah cockerels.

Trait	Oleuropein levels, mg/kg diet				SEM	P value
	0	50	100	150		
Total cholesterol , mg/dl	156.71[a]	140.64[b]	122.21[c]	119.84[c]	6.03	0.001
HDL, mg/dl	40.96 [c]	52.47[b]	61.43[a]	59.86[a]	0.91	0.001
LDL, mg/dl	116.24[a]	97.22[b]	83.91[c]	79.81[c]	1.56	0.001
AST , U/L	94.62[a]	83.11[b]	81.04[b]	78.86[b]	1.78	0.004
ALT, U/L	35.54[a]	27.11[b]	22.06[c]	20.97[c]	0.64	0.000
ALP, U/L	136.86[a]	121.02[b]	116.32[b]	109.86[b]	1.06	0.000

a, b, c Means in the same column with different superscripts are significantly different (P<0.05)
SEM: standard error of the mean.

Table (7): Effect of dietary oleuropein supplementation on immune and antioxidant responses in Bandarah cockerels.

Trait	Oleuropein levels, mg/kg diet				SEM	P value
	0	50	100	150		
WBCs, $10^3/mm^3$	4.03[c]	4.81[b]	5.21[b]	5.98[a]	0.071	0.000
Lymphocytes, %	58.51[b]	66.08[a]	65.04[a]	66.14[a]	0.618	0.001
Heterophils, %	36.22[a]	32.41[b]	33.56 [b]	27.10[c]	0.460	0.000
H/L	61.90[a]	49.05[b]	51.60[b]	40.97[c]	0.791	0.000
IgG, mg/dl	78.56[c]	88.13 [b]	88.71[b]	98.76[a]	0.084	0.000
IgM, mg/dl	166.43[c]	217.89[b]	221.72[b]	246.64[a]	0.791	0.000
TAC, mmol/l	0.611[d]	0.715 [c]	0.857 [b]	0.978[a]	0.10	0.000
SOD, U/ml	18.22[d]	21.61[c]	24.23[b]	27.63[a]	0.02	0.000
MDA, µmol/ml	2.77[a]	1.81 [b]	1.02[c]	0.833[d]	0.05	0.000

a, b, c,d Means in the same column with different superscripts are significantly different (P<0.05)
SEM: standard error of the mean.

Table (8): Economic efficiency of oleuropein supplementation for growing Bandarah cockerels.

Trait	Oleuropein levels, mg/kg diet			
	0	50	100	150
Total feed consumption[1] (kg)	5.007	4.791	5.067	4.865
Cost of Kg feed[2] (LE)	4.9	5.10	5.30	5.50
Chick cost at 28 day[3](LE)	14	14	14	14
Total cost[4] (LE)	38.53	38.43	40.86	40.76
Body weight (kg)	1.535	1.618	1.770	1.710
Market price[5] (LE)	49.12	51.78	56.64	54.72
Net revenue[6] (LE)	11.59	13.35	15.78	13.96
Economic efficiency[7] (EE)	30.08	34.74	38.62	34.25
Relative economic efficiency[8](REE) %	100	115.5	128.4	113.9

1-Total Feed Consumption (Kg) = feed consumption during the experimental period (84 days).
2- Price of Kg diet = 4.9 LE. 3- Chick cost at 28 days =14 LE
4- Total cost (LE) = 1 * 2 + 3. 5- Market Price = BW * 32 LE
6-Net Revenue (LE) = 5-4. 7-Economic Efficiency (EE) = Net revenue / Total cost X100.
8- Relative economic efficiency (REE), assuming control treatment = 100 %.

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الملخص العربى

تأثير استخدام الأوليوروبين على الاداء الانتاجى و الفسيولوجى لديوك البندرة في فترة النمو

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اجريت هذه التجربة لدراسة تاثير مستويات مختلفة من الأوليوروبين على الأداء الإنتاجي و الفسيولوجية والاستجابة المناعية لديوك البندرة خلال فترة النمو. تم توزيع 100 ذكر بندرة عمر 28 يوما بشكل عشوائي في أربع مجموعات 25 ذكر لكل منها. قسمت كل مجموعة الى خمس مكررات (5 ذكور لكل مكررة) واستمرت التجربه من 4 -16 اسبوع . المجموعة الأولى كنترول وتم تغذيتها على العليقه الأساسية. تم تغذية المجموعة الثانية والثالثة والرابعة على 50 ،100 ،150 ملليجرام من الأوليوروبين /كيلو جرام عليقة على التوالى. أوضحت النتائج ان استخدام مستوى 100 ،150 ملليجرام من الأوليوروبين /كيلو جرام عليقة حسن وزن الجسم ووزن الجسم المكتسب عند مقارنة مع المعاملات الأخرى. لم يكن هناك فرق معنوي في معدل استهلاك العلف في نهاية فترة التجربه بين جميع المعاملات. وتحسن معنويا اجمالى التحويل الغذائي خلال فترة التجربه لمستويات 50 ،100 ،150 ملليجرام من الأوليوروبين /كيلو جرام عليقة مقارنة مع مجموعة الكنترول. لم توجد اى فروق معنويه في خصائص الذبيحة بين جميع المعاملات. بينما انخفض عدد البكتيريا في الأمعاء لجميع مستويات الأوليوروبين مقارنة بالكنترول.
انخفض معنويا الكولسترول الكلي، ومستويات الكوليسترول منخفض الكثافةLDL،ونشاط انزيمات AST ALP ,ALT . بينما ذاد معنويا مستويات الكوليسترول عالى الكثافة HDL لمستويات 50 ،100 ،150 ملليجرام من الأوليوروبين /كيلو جرام عليقة مقارنة مع مجموعة الكنترول .أظهرت مكونات الدم أن قيم كرات الدم البيضاء WBCS تحسنت معنويا بزيادة مستويات الأوليوروبين وكانت افضل النتائج للديوك التي تغذت على 150 ملليجرام من الأوليوروبين /كيلو جرام عليقة. ذادت معنويا عدد الخلايا اللمفاوية للطيور التي تغذت على مستويات 50 ،100 ،150 ملليجرام من الأوليوروبين /كيلو جرام عليقة وانخفض عدد خلايا heterophils ونسبةH/L بشكل كبير مقارنة مع مجموعات الكنترول. تحسنت معنويا الحالة المناعيةIgG وIgM للكتاكيت التي تغذت على العلائق التي تحتوي على مستويات50 ،100 ،150 ملليجرام من الأوليوروبين /كيلو جرام عليقة. انخفض معنويا دليل اكسدة الدهون (المالونالدهيد) لديوك البندرة بزيادة مستويات الأوليوروبين ، وسجل أدنى مستوى للديوك التي تغذت على 150 ملليجرام من الأوليوروبين /كيلو جرام عليقة.بينما ذادت معنويا مستويات مضادات الأكسدة الكلية (TAC) وكذلك SOD بزيادة مستويات الأوليوروبين وكانت افضل النتائج للديوك التي تغذت على 150 ملليجرام. وأظهرت جميع مستويات الأوليوروبين المستخدمة كفاءة اقتصادية أفضل من مجموعة الكنترول وكانت افضلها 100 ملليجرام من الأوليوروبين /كيلو جرام عليقة مقارنة بجميع المعاملات حيث ادت الي زيادة الكفاءة الاقتصادية النسبية بمعدل28.4 ٪ عن مجموعة الكنترول.

الخلاصة:

استخدام مستوى 150 ملليجرام من الأوليوروبين /كيلو جرام عليقة حسن من أداء النمو، وقلل من عدد الميكروبات المعوية، و حسن من العوامل الفسيولوجية والحالة المضادة للأكسدة وزيادة الكفاءة الاقتصادية لديوك البندارة خلال فترة النمو.