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EFFECT OF DIETARY SUPPLEMENTATION OF OLIVE LEAF AND/OR GUAVA LEAF EXTRACTS ON GROWTH PERFORMANCE AND SOME BLOOD PARAMETERS OF GROWING RABBITS

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ABSTRACT

The present study was designed to investigate the efficacy of dietary ethanolic olive leaf (OLE) and guava leaf (GLE) extracts or their combination (MIX) on growth performance and some blood parameters of growing rabbits. Eighty weaned APRI line rabbits (5 weeks of age and average live body weight of 533 ± 5.73 g) were divided into four groups (20 rabbits/group, 10 males and 10 females). Rabbits in the control group were fed complete diet, while those in the OLEGLE and MIX treatment groups were fed the same diet supplemented with 1.5 ml OLE/kg, 3 ml GLE/kg and 1.5 ml OLE + 3 ml GLE/kg, respectively. Results showed that final body weight, daily weight gain, feed conversion ratio, relative growth rate and performance index were improved ($P<0.05$) in all groups compared to control group. Rabbits fed OLE, GLE and MIX diets were heavier by about 6.3, 9.4 and 10.7 % than those fed control diet, respectively. The feed conversion ratio was 3.39, 3.30, 3.25 and 3.65 in groups OLE, GLE, MIX and control, respectively. All extract supplementations increased ($P<0.05$) plasma total proteins, HDL and total antioxidant capacity, while decreased ($P<0.05$) triglycerides, total cholesterol, LDL and malondialdehyde.

In conclusion, 1.5 ml olive leaves extract and/ or 3 ml guava leaves extract/kg diet could be successfully incorporated into the diet of growing rabbits to improve feed utilization and growth during post-weaning stress period with high profitability, under Egyptian environmental conditions.

Key words: Olive leaf, Guava leaf, Growth performance, Blood parameters, Growing rabbits.

INTRODUCTION

Commercial rabbit production has been gaining much attention in recent years due to their high prolificacy, rapid growth rate, small body size and high meat yield. Rabbits can convert 20% of the dietary protein into edible meat, in comparing with 8-10% in beef cattle (Basavaraj *et al.,* 2011). It is well known that feed additives could be used safely in rabbit diets to improve their performance. Dietary feed additives were used in very small quantities with the objective of obtaining some special effects.

Guava (Psidium guajava) is a small tropical tree that grows up to 35 feet tall; it is widely grown for its fruit in tropics. Leaves and bark of Psidium guava tree have a long history of medicinal uses that are still employed today (Nwinyi *et al.,* 2008). The main chemical compounds in volatile oils of guava leaves were; pinene (11.77%), epi-bisabolol (10.85%), 1, 8-cineol (9.22%), 1-epi-cubenol (8.56%), globulol (5.88%), thujone (5.35%), hexenal (5.03%) and terpipineol (4.35%) (Ramadan *et al.,* 2009). Olive (*Olea europaea*) leaf (OL) is one of the potent source of plant polyphenols having antioxidant, antimicrobial, antiviral properties due to its rich phenolic contents. The most phenolic component of this content is oleuropein, which gives high palatability to olive or its oil. In order to utilize oleuropein and other bioactive components within OL effectively enough, they should be extracted from olive leaf. Olive leaf extract (OLE) contains compounds with potent antimicrobial activities against bacteria, fungi, and mycoplasma (Huang *et al.,* 2003).

Therefore, the present study was designed to investigate the efficacy of dietary ethanolic olive leaf and/or guava leaf extracts, as antioxidants, on growth performance and some blood parameters of growing rabbits.

MATERIALS AND METHODS

Animals and experimental design

The present study was carried out at rabbit farm of Sakha station, belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture, Egypt. Eighty weaned APRI line rabbits (5 weeks of age and average body weight (BW) of 533 ± 5.73 g) were divided according to BW into four experimental groups of 10 males and 10 females in each. Rabbits in the control group were fed complete basal diet without any supplements, while those in the OLE, GLE and MIX groups were fed the same diet supplemented with 1.5 ml olive leaf extract/kg, 3 ml guava leaf extract/kg and 1.5 ml OLE + 3 ml GLE/kg, respectively. The basal diet was formulated to cover all essential nutrient requirements for growing rabbits according to De Blas and Mateos (1998). Ingredients and chemical composition of the basal diet are shown in Table 1. Rabbits were kept in individual metal cages (25x50x40 cm) within close ventilated building with electric fans. Rabbit cages were supplied with feeder and water nipple. Means of ambient temperature and relative humidity inside the building were 23.5±4.5 °C and 62.5±3.5%, respectively. All rabbits were kept under the same management conditions. Feed and water were offered *ad libitum* throughout the experimental period (5 to 13 weeks of age).

Table 1: Ingredients and chemical composition of the basal diet

Ingredients	%	Chemical analysis: (on DM basis)	%
Berseem hay (*Trifolium alexandrinum*)	30.0	Dry matter (DM)	85.8
Barley grain	24.6	Organic matter (OM)	91.4
Wheat brain	21.5	Crude protein (CP)	17.4
Soybean meal (44% CP)	17.5	Crude fiber (CF)	12.4
Molasses	3.00	Ether extract (EE)	2.229
Limestone	0.95	Metabolizable energy (ME, kcal/kg)(2)	2257
Di-calcium phosphate	1.60	Calcium(2)	1.24
Sodium chloride	0.30	Phosphorus(2)	0.81
Mineral-vitamin premix(1)	0.30	Methionine(2)	0.45
DL-Methionine	0.20	Lysine(2)	0.86

(1) Mineral–vitamin premix provided the following per kilogram of diet: vitamin A, 150,000 UI; vitamin E, 100 mg; vitamin K3, 21 mg; vitamin B1, 10 mg; vitamin B2, 40 mg; vitamin B6, 15 mg; pantothenic acid, 100 mg; vitamin B12, 0.1 mg; niacin, 200 mg; folic acid, 10 mg; biotin, 0.5 mg; choline chloride, 5000 mg; Fe, 0.3 mg; Mn, 600 mg; Cu, 50 mg; Co, 2 mg; Se, 1 mg; and Zn, 450 mg.
(2) Calculated according to De Blas and Mateos (1998).

Guava and olive leaves used in this study were collected during summer (September) from Borg El-Arab region, Alexandria governorate, Egypt. The collected guava and olive leaves were cleaned from extraneous matter, shade-dried with passive ventilation and crushed into a fine powder. The air dried plant materials were ground in a blender with a particular size to ensure the plant powders in identical size. The powder (50 g) was macerated in 150 ml ethanol (75%) and allowed to extract for 48 h. The resultant (dark green-brown mixture) was filtered (Mazumdar *et al.*, 2015). The crude extract was kept in refrigerator in glass bottles until the further experiments.

Experimental procedures

Throughout the experimental period, body weight, feed intake and number of dead rabbits were recorded and then daily weight gain, feed conversion ratio and mortality rate were calculated. Relative growth rate and performance index were calculated (North, 1981).

Blood samples (3 ml per rabbit) were collected from three male rabbits in the morning before feeding at the end of experimental period, from marginal ear vein to determine blood biochemicals. Blood samples were aspirated in EDTA vacuum tubes. Plasma was separated by centrifugation at 4000 rpm for 10 min and frozen at −20 °C until analysis. Plasma concentration of total proteins, triglycerides, total cholesterol, high density lipoproteins (HDL) and low density lipoproteins (LDL) were

calorimetrically determined using commercial kits (purchased from Bio-diagnostic, Egypt) according to the manufacturers' instructions. Total antioxidant capacity (TAC) and Malondialdehyde (MDA) were determined calorimetrically in blood plasma of rabbits.

Statistical analysis

Data were statistically analyzed by one-way ANOVA using the General Linear Model Program of SAS (2000). Duncan's multiple range tests was performed (Duncan, 1955) to detect the significant differences among means at a level of $P<0.05$.

RESULTS AND DISCUSSION

Data in Table 2 showed the body weight at 13 weeks, daily weight gain, feed conversion ratio, relative growth rate and performance index were significantly ($P<0.05$) improved in rabbits of treatment groups compared to control one. However, feed intake was not affected by treatment. Rabbits fed OLE, GLE and MIX diets were heavier by about 6.3, 9.4 and 10.7 % than those fed control diet, respectively. The corresponding increase in daily weight gain was 9.3, 13.7 and 15.7 %, respectively. Similarly, Oke *et al.* (2017) found that OLE supplementation in the drinking water of broiler chickens significantly increased final body weight, weight gain and feed conversion ratio.

Table 2: Effect of experimental diets on growth performance (5-13 weeks of age) and biochemicals in blood plasma (13 weeks of age) of growing rabbits

Parameter	Control	OLE	GLE	MIX	SEM	P-value
Productive performance:						
Rabbits (n)	20	20	20	20	-	-
Initial body weight (g)	635	632	634	632	5.728	0.9736
Final body weight (g)	2022^{c}	2149^{b}	2212^{ab}	2238^{a}	25.56	0.0001
Daily weight gain (g/h/d)	24.8^{c}	27.1^{b}	28.2^{ab}	28.7^{a}	0.451	0.0001
Feed intake (g/h/d)	90.2	91.4	92.6	92.9	1.066	0.1839
Feed conversion ratio	3.649^{a}	3.388^{b}	3.301^{b}	3.251^{b}	0.059	0.0002
Relative growth rate (%)	104.3^{b}	109.0^{a}	110.8^{a}	111.8^{a}	1.042	0.0001
Performance index (%)	55.7^{c}	63.9^{b}	67.5^{ab}	69.3^{a}	1.789	0.0001
Plasma biochemicals:						
Total proteins (g/dl)	5.72^{b}	6.16^{a}	6.40^{a}	6.46^{a}	0.128	0.0169
Triglycerides (mg/dl)	96.7^{a}	92.5^{b}	91.1^{b}	90.0^{b}	0.872	0.0065
Total cholesterol (mg/dl)	94.6^{a}	84.3^{b}	82.8^{b}	81.9^{b}	0.818	0.0001
HDL (mg/dl)	33.8^{b}	36.5^{ab}	37.7^{a}	37.1^{a}	0.869	0.0448
LDL (mg/dl)	46.8^{a}	39.7^{b}	37.6^{bc}	37.2^{c}	0.698	0.0001

$^{a, b c}$, Means in the same row with different superscripts are significantly different ($P<0.05$).
OLE: Control diet + 1.5 ml olive leaf extract/kg. GLE: Control diet + 3 ml guava leaf extract/kg.
MIX: Control diet + 1.5 ml olive leaf extract and 3 ml guava leaf extract/kg. SEM = Standard error of means.

Data in Table 2 also revealed that supplementing the diet of growing rabbits with olive and/or guava leaves extracts significantly ($P<0.05$) increased plasma total proteins concentration, while significantly ($P<0.05$) decreased plasma triglycerides, total cholesterol and LDL concentrations compared with control diet. However, plasma HDL concentration significantly ($P<0.05$) increased only in GLE and MIX groups compared to control one. These results reflected pronounced effect of guava extract administration on lipid profile, which was attributed to that GLE, as a source of omega-3 fatty acids, which may impair the hepatic lipogenesis leading to decreased triglycerides concentrations in blood plasma (Bölükbaş and Erhan, 2007). The mechanism of this hypo-cholesterolaemic action may be due to the inhibition of dietary cholesterol absorption in the small intestine or its production by liver and/or stimulation of the biliary secretion of cholesterol and increasing cholesterol excretion in the feces (Rezar *et al.*, 2015).

Results of antioxidant capacity illustrated in Figure 1 revealed significant ($P<0.05$) increase in total antioxidant capacity (TAC) and significant ($P<0.05$) decrease in malondialdehyde (MDA) concentration in blood plasma of rabbits fed OLE, GLE and MIX. The best results were obtained by feeding rabbits with MIX diet, which may suggest antioxidant property of guava extract beside the

antioxidant properties of OLE via increasing antioxidant defense system along with decreasing lipid peroxidation and reactive oxygen species generation, in term of reducing MDA concentration. According to Hayes *et al.* (2011), phenolic compounds in the OLE are considered as a free radical scavenger by breaking the free radical chain reaction.

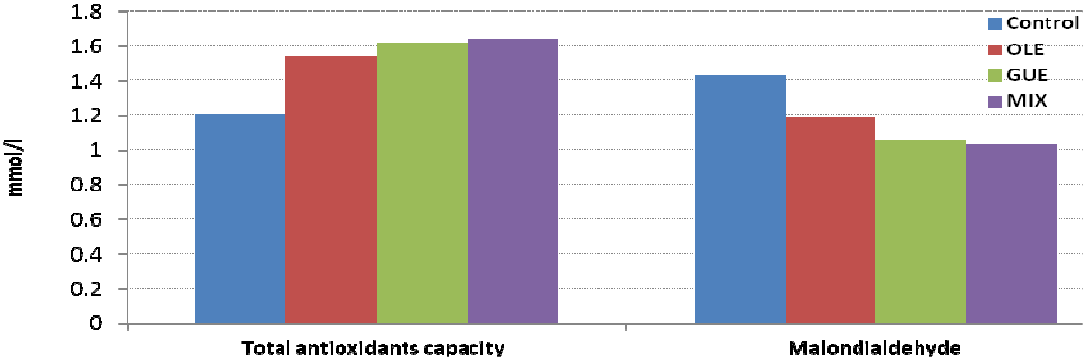

Figure 1: Effect of experimental diets on antioxidant capacity in blood plasma of rabbits in experimental groups.
OLE, GUE, MIX see in Table 2.

CONCLUSIONS

Based on the foregoing results, 1.5 ml olive leaves extract and/or 3 ml guava leaves extract/kg diet could be successfully incorporated into the diet of growing rabbits to improve feed utilization and growth during growing period with high profitability, under Egyptian environmental conditions.

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