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EFFECT OF DIETARY LEMONGRASS OIL OR VITAMIN E ON PERFORMANCE, DIGESTIBILITY COEFFICIENTS, CARCASS TRAITS AND MEAT QUALITY OF RABBITS

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ABSTRACT: *This study was conducted to determine the effect of supplemented rabbit diets with lemongrass (Cymbopogoncitratus) oil (LGO) or vitamin E (α-tocopheroyl acetate, Vit E) on performance, digestibility coefficients , carcass traits and meat quality of rabbits. Sixty growing New Zealand White (NZW) rabbits aged 8 weeks were divided randomly into four equal groups with three replicate (5 rabbit in each). Rabbits were distributed into four dietary treatments included a control diet without any feed additive, a diet containing 150mg Vit E /kg diet, Vit E, a diet containing 100 mg LGO /kg diet and a diet containing 150 mg LGO /kg diet during the growth period. Rabbits were fed to allow ad-libitum in feeding trial lasted 56 days.*

The results showed that *rabbits fed diet contain 150 mg Vit E /kg diet and 150 mg LGO /kg diet recorded significantly higher final live weight and total weight gain as compared to the control and group fed diet contained 100 mg LGO /kg diet. Rabbits fed dietary 150 mg LGO recorded the best feed conversion ratio. The digestibility coefficients for CP and nutritive values in terms DCP and TDN of were significantly higher with Vit E and LGO supplementation. Supplementing 150 mg/kg diet Vit E increased significantly (P<0.05) OM digestibility coefficient. Adding LGO supplementation to rabbit diets significantly (P<0.01) increased carcass, dressing and total edible parts percentages. However, there were no significant differences between groups for heart, kidney, liver and giblets percentages. Total cholesterol content in meat decreased significantly (P<0.05) decreased in group fed 150 mg LGO as compared to the control group. Triglycerides and MDA concentrations were significantly lower in treatments group when compared with* the control. *There were no significant between experimental diets in pHu of meat, while drip loss % were significantly (P<0.05) decreased compared to those of the control.*

Conclusively, *it could be concluded that adding lemongrass oil or vitamin E as feed supplementation in growing rabbit's diet improved growth performance, digestion coefficients dressing percentages and meat quality. Also, supplemented rabbits diet 150 mg LGO/kg diet led to improvement economic efficiency than that of 150 mg Vit E/ kg diet and free from additives.*

Keywords: *Lemongrass oil, Vitamin E, Growth performance, Nutrients digestibility, Carcass characteristics, Meat quality.*

INTRODUCTION

Rabbit meat represents excellent nutritive prosperities as it is highly digestible and tasty (Combes, 2004; Hern`andez and Gondret, 2006). This meat is lean, rich in proteins, low in cholesterol and high in polyunsaturated fatty acids, which enhance human health (Bazan, *et al*., 2011; Wall *et al*., 2010). During metabolism, the body produces antioxidant gets rid of free radicals produced (oxidants), but oxidative stress develops when oxidants generation exceeds the body's antioxidant production (Roth, 2000). Lipid oxidation changes the meat flavor, texture and nutritional (Gil *et al*., 2001).

In the last decade, food industry has used synthetic antioxidants (Brand-Williams *et al*., 1995), which is considered a health risk (Hettiarachchy *et al*., 1996), besides consumers prefer natural antioxidants than synthetic (Barlow, 1990). Animal feed influence the meat composition of mono gastric livestock. Supplementing rabbit diets with plant extract and vitamin E improve meat quality (Botsoglou *et al*., 2004; Cardinali *et al*., 2015). The natural antioxidant may effectively inhibit the oxidation of muscle tissue (Botsoglou *et al*., 2004) and protects cellular membranes against oxidative damage (Morissey *et al*., 1994). Besides, these natural additives enhance the taste and improving the flavor of the feed and have positive effects on digestion and intestinal health and enhanced animal performance (Krieg *et al*., 2009).

Lemon grass (*Cymbopogon citrates*) is an aromatic perennial plant of the family Poaceae that has been used to extract essential oils. It is grown around the world and has used in traditional therapeutic in many countries (Aftab *et al*., 2011; Tarkang *et al*., 2012). *Cymbopogon citrates* essential oil has many pharmaceutical activities as antibacterial (Wannissorn, *et al*., 2005), antifungal (Nakagawa *et al*., 2003), antiprotozoal (Holetz *et al*., 2003), antioxidant (Masuda *et al*., 2008), anti-inflammatory (Abe *et al*., 2004), anti-carcinogenic

(Puatonachokchai *et al*., 2002) and cardio protective (Gazola *et al*., 2004). It has also been used to treat diabetes (Mansour *et al*., 2002), gastrointestinal disturbances (Carlini *et al*., 1986) and flu, fever, and pneumonia (Negrelle and Gomes, 2007), as well as inhibit platelet aggregation (Tognolini *et al*., 2006).

The essential oil of *Cymbopogon citrates* contains Citral, myrcene, geranial, geraniol, limonene, burneol, citronellol, nerol, neral, α-terpineol, elemicin, caffeic acid, apigenin, luteolin, kaempferol, quercetin, chlorogenic acid, and geranyl acetate (Bharti *et al*., 2013). It also contains fumesol, furfurol, isopulegol, isovaleranic aldehyde, L-linanool, methylheptenone, n-decyclic aldehyde, terpineone, p-coumaric acid, valeric and esters (Negrelle and Gomes, 2007; Akhila, 2010; Faruq, 1994). Kassahun and Gezu (2019) reported that the essential oil of lemon grass contains twenty volatile components, and the main components are alpha-pinene (25.55%), D-limonene (5.69%) and eucalyptol (55.43%), also eucalyptol is major constituent which is aromatic in nature. On the other hand, Negrelle and Gomes (2007) showed that citral is the high content of essential oil (about 80%) which is responsible for the lemony smell.

Vitamin E which is considered as nature antioxidant (Brigelius-Flohe and Bold, 1999), has several other biological activities such as regulation of cellular signaling and gene activity and modulation of immune function (Azzi *et al*., 2002; Brigelius-Flohe *et al*., 2002).

Therefore, the aim of the present study was to investigate the effect of lemon grass oil and vitamin E supplementation on performance, digestibility, carcass characteristics and meat quality of growing rabbits.

MATERIALS AND METHODS

Animal, management and dietary treatments

A total number of sixty New Zealand White (NZW) weaned rabbits at 6 weeks were allocated to four dietary groups. Rabbits were individually housed in wire cage and drinking water and diets were supplied *ad-libitum*. The experimental period lasted for 56 days and first group was the control group with no additive. The second group supplemented with vitamin E (150 mg/kg diet). The third and fourth groups were supplemented with lemon grass oil (LGO) at 100 and 150 mg/ kg diet, respectively. All diets were *iso-nitrogenous and iso-energetic*. The chemical composition of the experimental diets was reported in Table 1. Basal diet was formulated according to NRC (1977).

Table1: Ingredients and chemical composition of the basal experimental diet of growing rabbits.

Items	**%as feed**
Ingredients:	
Alfaalfa hay 15%	28.00
wheat bran	21.35
Barley	18.40
Yellow corn	11.20
Soybean meal 44%	14.75
Molasses	2.50
Di calcium phosphate	2.20
Calcium carbonate	0.70
Sodium chloride	0.30
Vitamins and minerals premix[1]	0.30
DL-Methionine	0.30
Total	**100**
Calculated chemical composition	
Crude protein (%)	17.44
Digestible energy, kcal/kg	24959
Ether extract (%)	2.45
Crude fiber (%)	12.25
Calcium (%)	1.17
Total p (%)	0.92
Na (%)	0.18
Lysine (%)	0.82
Methionine (%)	0.54
Methionine+ Cyctine (%)	0.82

[1]Mineral and vitamin mixture supplied per kg of diet: Vitamin A 60000 IU, Vitamin D3; 900 UI, Vitamin E; 40 mg, vitamin K3; 2 mg, Vitamin B1; 2mg, Vitamin B2; 4 mg, Vitamin B6; 2 mg , Vitamin B12; 10µg, Folic acid; 10 mg, Pantothenic acid; 7 mg, Nicotinic acid; 50 mg, Biotin; 50 µg, Choline chloride; 250 mg, I; 0.2 mg, Mn; 85 mg, Cu; 5 mg, Zn; 50 mg, Fe; 50 mg, Co; 0.1 mg, , Selenium; 0.1 mg.

Growth performance

Live body weight and feed intake were recording weekly from weaning to the end of experimental period. The change in live body weight during

experimental period was calculated as the weight gain, also the feed conversion ratio was calculated.

Nutrient digestibility coefficients

At the last week of the experimental period (14 weeks of age) a digestion trail was run to demine digestibility of nutrients. Samples of feed and feces were daily collected form rabbit (4 per each treatment). Rabbits were individually housed in metabolic cages which fresh water and diets were daily provided. The feces samples were oven- dried at 60°C for 24 h and then were ground for chemical analyses. Digestibility of nutrients was measured as described by Cheeke (1987). Chemical analyses of diets and feces were done according to the classical (AOAC, 1996).

Carcass characteristics

At the end of the growth experiment, three rabbits of each treatment were fasted for 12 hours, and then slaughtered. The hot carcass, liver, kidneys and heart were weighted calculated as percentage from live body weight; also the dressing, giblets and total edible parts were calculated as percentage from live body weight.

Meat quality

Three carcasses from each group were randomly collected and used for meat quality analyses at 24 h post mortem (2-4°C). The L. lumborum muscles (between the 1st and 7th lumbar vertebra) were used to determine ultimate pH (pHu) and drip loss. The ultimate pH (pHu) was measured on the same muscles and then each carcass was dissected as recommended by Blasco, *et al*., (1993). Drip loss (DL) was determined as the percentage of the difference between weights before and after chilling for 24 h. and divided by the first weight according to Lundström and Malmfors, (1985).The cooking loss was determined according to Omojola and Adesehinwa, (2006).

Furthermore, Mixture of meat were stored on -20°C for 4 days before chemical measurements, total protein, total cholesterol, triglycerides and malondialdehyde (MDA) contents were determined by colorimetric methods using analytical kits produced by Biodiagnostic Company, Egypt.

Statistical analysis:

Data were statistically analyzed using Least Squares Analysis of Variance according to Snedecor and Cochran (1982) using the general linear model (GLM) procedure of SAS User's guide **(SAS, 2001)** using the following fixed model:

$$Y_{ij} = \mu + Ti + e_{ij}$$

Where, Y_{ij} = The observed value of a given dependent variable, μ = Overall adjusted mean, Ti = Fixed effect of the treatments, i = 1, 2 ……..5,e_{ij} = Random error of the model.

The differences between LSM (least square means) were analyzed by Duncan's New Multiple Range test (Duncan, 1955). Data in percentage values were transformed with the arcsine square root procedure to normalize variance before analysis.

RESULTS AND DISCUSSIONS

Growth performance

The effects of dietary LGO and VitE on the performance of growing rabbits are shown in Table 2. There were no difference in final live weight and total weight gain between rabbits fed diet contained 100 mg LGO /kg diet and the control group. On the other hand, rabbits fed basal diet supplemented with 150mg VitE /kg diet and

Table 2: Effect of supplementing diet with lemongrass (LGO) and VitE on rabbit performance.

Items	Experimental groups				Pooled SE	Sig
	Control	VitE150 mg/kg	LGO100 mg/kg	LGO150 mg/kg		
Initial live weight (g)	735	733.75	745.63	700.63	43.94	NS
Final live weight (g)	2278.75^{b}	2446.25^{a}	2303.13^{b}	2448.75^{a}	40.18	**
Total weight gain (g)	1543.75^{b}	1712.5^{a}	1557.5^{b}	1748.13^{a}	16.68	**
Total feed intake (g)	5456.63^{ab}	5544.63^{a}	5290^{c}	5324^{bc}	54.6	**
FCR	3.53^{a}	3.24^{c}	3.4^{b}	3.05^{d}	0.01	**

$^{a, b, \ldots}$ Means within each row have no similar letters are significantly different ($P \leq 0.01$)

150 mg LGO /kg diet significantly (P<0.01) recorded higher final live weight by 7.35% and 7.46%, respectively and higher total weight gain by 10.93 and 13.24%, respectively compared to the control group. There were no significant differences in final live weight and total weight gain between rabbits fed basal diet supplemented with 150 mg VitE /kg diet and 150mg LGO /kg diet. Total feed intake was significantly decreased with supplementing diets with 100 mg LGO /kg. Feed

conversion ratios were significantly improved with supplemented diets with 150 mg/kg diet VitE and 100 and 150 mg LGO /kg by 8.21, 3.68 and 13.6% compared with the control group, and the best group was contained 150 mg LGO /kg.

These results are in agreement with Selim, *et al*., (2008) who found that supplementing diets with vitamin E improved growth performance of growing rabbits. On the other hand, Al-Sagheer, *et al*. (2017a) reported that supplemented growing New Zealand rabbit diets with lemon grass oil increased live body weight and daily body weight gain and improved feed conversion ratio. Also, Malee, *et al*., (2000) concluded that addition of lemon grass oil to weanling pig diets were significantly increased the productive performance. While, Al-Sagheer, *et al*., (2017b) observed an improvement in growth performance of fish fed diets supplemented with 200 and 400 mg LGO /kg as compared with control group. The same trend observed in broiler chickens, Tiwari *et al*., (2019) found that supplemented diet with 400 ml/100 LGO / kg diet improved growth performance. The improvement in growth performance could be due to the antioxidant activity of Vit E (Brigelius-Flohe and Traber, 1999) and LGO (Masuda, *et al*., 2008), which improved the antioxidant status of rabbits. The growth enhancing effect of LGO could be strongly correlated with their strong antibacterial (Wannissorn *et al*., 2005) and antimicrobial activity (Oussalah *et al*., 2007). Also, citral has an immunomodulatory activity (Bachiegaand Sforcin, 2011), and Vit E modulate the immune function (Azzi *et al*., 2002).

Nutrient digestibility coefficients

The effects of dietary supplementation with VitE and LGO on nutrient digestibility coefficients and nutritive values of growing rabbits are graphically presented in Table 3.

There were no difference between treatments in DM, CF, EE and NFE digestibility coefficients among treatments. The digestibility coefficients of OM and CP increased significantly increased in the experimental diets contained 150 mg Vit E /kg diet as compared with the control and the group contained 100mg LGO / kg diet. Nutritive values (TDN and DCP) significantly increased in experimental diets compared to control diet. In this respect, Al-Sagheer *et al*., (2017a) showed that digestibility of CP and the nutritive values of DCP significantly ($P<0.05$) increase with LGO supplementation to the heat-stressed growing rabbits as compared to control group. The positive effect of Vit E and LGO on the digestibility traits may be due to that both of them have antioxidant activity ((Brigelius-Flohe and bold, 1999 and Masuda *et al*., 2008).

Table 3: Effect of supplementing diet with lemongrass (LGO) and Vit E on Nutrient digestibility coefficients and nutritive values of growing rabbits:

Items	Experimental groups				Pooled SE	Sig
	Control	Vit E 150mg/kg	LGO 100mg/kg	LGO 150mg/kg		
DM	64.12	67.7	65.1	65.66	0.56	NS
OM	65^{b}	68.5^{a}	65.78^{b}	66.2^{ab}	0.7	*
CP	73.81^{b}	78.76^{a}	75.67^{bc}	76.53^{ab}	0.63	**
CF	34.32	39.94	35.71	35.9	1.13	NS
EE	66.92	71.1	70.17	69.37	1.15	NS
NFE	68.6	71.17	68.77	69.2	0.61	NS
Nutritive value (% DM)						
DCP	13.44^{c}	14.34^{a}	13.78^{bc}	13.95^{ab}	0.17	**
TDN	61.76^{b}	65.1^{a}	62.6^{b}	62.96^{ab}	0.5	*

a, b and c: Means in the same row having different superscripts differ significantly.

Carcass characteristics

The effects of supplementing diet with LGO and VitE on dressing, carcass, heart, kidney, liver, giblets and total edible parte percentages are shown in Table 4. There were no significant effects due to supplementing diet with LGO and Vit E on heart, kidney, liver and giblets percentages. Supplementing growing rabbit diets with LGO significantly increased dressing, carcass and total edible parte, whereas there was no effect due to Vit E supplementing.

Omer *et al*., (2010) found that adding 0.5% lemon grass to New Zealand White male rabbits aged 8 weeks significantly ($P<0.05$) increased dressing percentages (DP) calculated as carcass weight/empty body weight compared to the control diet. Al-Sagheer *et al*., (2017a) mentioned that there was no significant effect in dressing percentage in growing rabbits fed diet supplemented with LGO under heat-stress condition compared to the control group.

Meat quality

The effect of using LGO and Vit E as feed additives on growing rabbit diets on the meat traits are presented in Table 5. These results indicate that the percentages of total protein in meat were not significantly changed in the experimental groups compared with the control group. These results are in agreement with Mukhtar *et al*., (2012) who reported that there were no significant

Table 4: Effect of supplementing diet with lemongrass (LGO) and VitE on carcass characteristics of rabbit of growing rabbits.

Items	Experimental groups				Pooled SE	Sig
	Control	VitE 150mg/kg	LGO 100mg/kg	LGO 150mg/kg		
Dressing (%)	54.33[b]	56.08[b]	72.42[a]	74.62[a]	5.26	**
Carcass (%)	44.73[b]	45.67[b]	62.9[a]	65.80[a]	0.4	**
Heart (%)	0.33	0.33	0.33	0.37	3.33	NS
Kidney (%)	0.7	0.63	0.63	0.57	0.07	NS
Liver (%)	0.31	0.38	0.33	0.27	0.003	NS
Giblets (%)	4.17	4.73	4.37	3.67	0.004	NS
Total edible parts (%)	48.9[b]	50.4[b]	67.3[a]	79.5[a]	0.05	**

[a, b,...] Means within each row have no similar letters are significantly different ($P \leq 0.01$)

Table 5: Effect of supplementing diet with LGO and VitE on chemical measurements of meat quality of growing.

Items	Experimental groups				Pooled SE	Sig
	Control	VitE 150mg/kg	LGO 100mg/kg	LGO 150mg/kg		
Total protein (mg/100g)	735	733.75	745.63	700.63	43.94	NS
Total cholesterol (mg/100g)	180[ab]	168.33[bc]	186.67[a]	167.5[c]	0.01	*
Triglycerides (mg/dl)	136.2[a]	128.33[ab]	117.23[b]	117.03[ab]	35.32	**
Malondialdehyde (nmol/mg)	5.2[a]	4.49[b]	4.75[ab]	4.37[b]	0.07	*
pHu of meat	6.02	5.96	5.98	5.84	0.02	NS
Drip loss %	26.78[a]	17.22[b]	19.11[b]	17.33[b]	1.49	*

a, b and c: Means in the same row having different superscripts differ significantly.

differences (P>0.05) in crude protein among groups supplemented with lemon grass in meat traits in broilers. Total cholesterol percentages were higher in the groups fed diet contains 100mg/kg LGO, and lower in the groups fed diets contain 150mg/kg Vit E and 150mg/kg LGO than the control. Also, Total cholesterol percentages were lower in groups fed diet contains 150mg/kg LGO when compared with diets contains150mg/kg Vit E. Triglycerides percentages were significantly lower (P<0.01) in treatment diets compared with the control. There were no differences between groups fed diets contains 150mg/kg LGO

and150mg/kg Vit E. There were no differences in pHu among experimental groups. Also, Drip loss % of meat were (P<0.05) significantly decreased in all experimental groups.

In connection with total cholesterol contents in meat, it decreased with adding 200 mg vitamin E in pigs feed (Souza and Silva, 2006) and in poultry feed (Zdanowska-Sąsiadek, *et al*., (2016). The concentrations of malondialdehyde (MDA) in muscles were significantly (P<0.05) lower in experimental groups compared with the control group. There were no differences between rabbits fed diets contained 150mg LGO /kg and150mg VitE /kg in meat MDA concentration. These results were in agreement with Al-Sagheer, *et al*., (2017a) which found that supplemented growing NZW rabbits with lemon grass oil significantly (P< 0.05) decreased MDA concentrations compared to the control in heat stress condition. Also, Zhang *et al*., (2012) mention that supplemented diet with vitamin E suppressed MDA in rabbit meat.

Economic Efficiency:

The economic efficiency of the experimental diets is summarized in Table 6. Rabbits fed on diets supplemented with 150 mg LGO /kg recorded the best value of relative economic efficiency 110.30 % followed by 150 mg Vit E /kg diet. 106.29 % when compared to the control group.

Table 6: Input- output analysis and economic efficiency of experimental dietary treatment.

Item	**Experimental groups**			
	Control	VitE 150mg/kg	LGO 100mg/kg	LGO 150mg/kg
Body weight gain (g)	1543.75	1712.5	1557.5	1748.13
Price/kg sold for body weight	54.00	54.00	54.00	54.00
Total revenue / rabbit (LE)	83.36	92.47	84.10	94.23
Total feed consumption/rabbit (kg)	5.46	5.54	5.29	5.32
Price/kg feed (LE)	5.20	5.45	5.50	5.65
Total feed cost /rabbit (LE)	28.39	30.19	29.09	30.05
Net revenue [1] (LE)	54.97	62.28	55.01	64.18
Economic efficiency[2]	193.62	206.29	189.10	213.57
Relative economic efficiency[3](%)	100.00	106.29	97.66	110.30

Total price for feeds was calculated according to the price of different ingredients available in ARE. Price of one Kg live weight was 54 LE, [1]Net revenue= total revenue/ chick- total feed cost/chicks, [2] Economic efficiency= net revenue/ total feed coast/chicks , 3Relative economic efficiency of the control, assuming that the relative E1 of the control =100

Conclusively, it could be concluded that supplementing dietary with 150 mg/kg lemongrass oil or vitamin E improved growth performance, nutrient digestibility and meat quality of growing rabbits without probable side effects. Lemongrass oil improved carcass characteristics while vitamin E had no effect. Supplementation of 150 mg LGO /kg led to improvement economic efficiency than that of 150 mg VitE /kg diet and free from additives.

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تأثيرعلائق زيت حشيشة الليمون أو فيتامين هـ علي الأداء ومعاملات الهضم ومواصفات الذبيحه وجودة اللحم في الارانب

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تم إجراء هذه التجربة لمعرفة تأثيرزيت حشيشة الليمون او فيتامين هـ على الأداء الإنتاجي ومعاملات الهضم وخصائص الذبيحة وجودة اللحم. تم تقسيم ستون من الأرانب النيوزيلندية النامية الذين تتراوح أعمارهم بين 8 أسابيع بشكل عشوائي إلى أربع مجموعات متساوية مع ثلاثة مكررات (5 أرانب في كل مكرر). اشتملت المعاملات علي مجموعة مقارنة بدون أي إضافات ومجموعة تحتوي 150 ملجرم فيتامين هـ /كجم عليقة ومجموعتان تحتويان علي زيت الليمون بمقدار 100 و 150 ملجرم/كجم عليقة. واستمرت التجربة لمدة 42يوم مع توافر الغذاء والماء بشكل دائم.

أظهرت النتائج أن الأرانب التى تم تغذيتها على علف يحتوي على 150 مجم من فيتامين هـ / كجم عليقة و 150 مجم زيت حشيشة الليمون / كجم عليقة سجلت معنوياً أعلى وزنً جسم حيً و زيادة في وزن الجسم مقارنة بالمجموعة المقارنة والمجموعة المغذاة على 100 مجم زيت حشيشة الليمون / كجم عليقة. سجلت المجموعة المغذاة علي عليقة تحتوي علي 150 ملجم زيت حشيشة الليمون / كجم عليقة أفضل معامل تحويل غذائي. زادت معاملات هضم البروتين الخام والقيم الغذائية لكل من البروتينات الخام المهضومة و المركبات الغذائية الكلية المهضومة للأنظمة الغذائية التجريبية بشكل كبير مع المجموعات المغذاة علي عليقة تحتوي علي فيتامين هـ أو زيت حشيشة الليمون. أدت إضافة 150 مجم فيتامين هـ / كجم عليقة من أو 150 مجم زيت حشيشة الليمون / كجم عليقة إلى زيادة ملحوظة في معامل هضم المادة العضوية. أدت إضافة زيت حشيشة الليمون إلى زيادة معنوية في وزن الذبيحة والتصافي والأجزاء المأكولة. ومع ذلك لم تكن هناك فروق معنوية بين المجموعات في نسبة القلب والكلى والكبد . لم يكن هناك تأثير معنوي لإضافة فيتامين هـ على خصائص الذبيحة. انخفض معنوياً محتوي الكوليسترول الكلي في اللحم في المجموعة المغذاة علي عليقة تحتوي على 150 مجم زيت حشيشة الليمون / كجم عليقة والمجموعة المغذاة علي عليقة تحتوي على 150 مجم فيتامين هـ / كجم عليقه مقارنة مع مجموعة المقارنة. انخفض التراي جلسريد و المالونالدهيد بشكل ملحوظ في المعاملات مقارنة مع المجموعة المقارنة.لم تكن هناك فروق بين المجموعة التي تم تغذيتها بـ 150 مجم زيت

حشيشة الليمون / كجم عليقة والمجموعة التي تمت تغذيتها بـ 150 مجم فيتامين هـ / كجم عليقة في تركيز الكوليسترول الكلي والدهون الثلاثية والمالون الدهيد في اللحم. لم تكن هناك فروق معنوية بين المعاملات في درجة الحموضة في اللحم بينما تحسن معدل فقد السوائل في اللحم معنويا مقارنة بالمجموعة المقارنة.يمكن أن نستنتج أن إضافة زيت حشيشة الليمون أو فيتامين (هـ) إلي عليقة الأرانب النامية يؤدي إلى تحسن الأداء الإنتاجي ، ومعاملات الهضم ، نسبة الذبيحة وجودة اللحم. كما أن إضافة 150ملجم من زيت حشيشة الليمون حسنت الكفاءة الأقتصادية بالمقارنة بمجموعتى مجموعة فيتامين هـ ومجموعة الكنترول.

التوصية:يمكن أن نستنتج مما سبق أن إضافة زيت حشيشة الليمون أو فيتامين (هـ) إلي عليقة الأرانب النامية يؤدي إلى تحسن الأداء الإنتاجي ، ومعاملات الهضم ، نسبة الذبيحة وجودة اللحم. كما أن إضافة 150ملجم من زيت حشيشة الليمون /كجم عليقة حسنت الكفاءة الأقتصادية بالمقارنة بمجموعتى مجموعة فيتامين هـ ومجموعة الكنترول.