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Effect of Thyme Leaves (thymus vulgaris L) and Ascorbic Acid as Natural Growth Activates on the Performance, Carcass traits, and Digestibility of Growing Rabbits

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Abstract

Thirty-six growing Rabbits male, 5 weeks old, with initial weights of 776.67±9.71 gm were used for the study. The rabbits were randomly allocated to four treatments groups of 9 rabbits each. Group one fed basal diet free of feed additives and served as a control group. Groups 2 and 3 supplemented with 200 and 400 mg Thyme leaves / kg diet, respectively. Group 4 received control diet, but drinking water supplemented with 200 mg ascorbic acid /L.Results showed that at 13 weeks of age the supplementation of 200 mg ascorbic acid, 200 and 400 mg Thyme leaves /kg diet brought a significant ($P \leq 0.05$) improvements in final body weight(g) by the value of 2119.4, 2250, 2360.6 and 2232.8 total of weight gain(g) by 1341.7,1502.8,1584.4 and 1457.2 feed conversion ratio by 3.83,3.22,2.96 and 3.43 and significantly ($P \leq 0.01$) decreased daily feed intake(g) by 91.42,86.78,86.77 and 90.2, respectively. Most of the carcass traits were insignificantly affected by different treatments, however, kidney fat and lungs percentage were significantly ($P \leq 0.05$) decreased and increased, respectively, in the group received 400 mg Thyme leaves in comparison with control. Digestibility coefficients of DM was insignificantly ($P \leq 0.05$) decreased in the groups received Thyme leaves, however, digestibility coefficients of OM was insignificantly ($P \leq 0.05$) but decreased in the group had 400 mg Thyme leaves in compared with control and ascorbic acid fed groups. Diets containing Thyme leaves caused significant ($P \leq 0.05$) increment in DCP % value compared with control and ascorbic acid fed groups. In conclusion the results showed that addition of Thyme leaves or ascorbic acid in rabbit diets had improved the productive performance, carcass, digestibility of growing rabbits and 400 mg/kg Thyme leaves was more effective tan 200 mg/kg Thyme leaves or ascorbic acid.

Keywords: Rabbits- Thyme leaves- ascorbic acid–performance.

1. Introduction

The Since the European Union EU first limited and then definitively banned the use of antibiotics as growth promoters in animal feeding (Anadon, 2006), public opinion on antibiotic use by humans in the USA has changed progressively and scientific studies have increasingly focused on natural alternatives (Franz, et al. 2010), The EU decision stemmed from the concern that low-continuative dosage of antibiotics to either enhance animal performance or for simple prophylaxis purposes could lead to the formation of resistant strains of human pathogens that pose a real sanitary risk to the population (Wegener, 2003). As a result, new commercial additives of plant origin, considered to be natural products that consumers would accept, have been proposed to livestock producers. Herbs, spices, and various plant extracts have received increased attention as possible antibiotic growth promoter replacements. Some of the important aspects

associated with herbal additives are their ability to prevent digestive disturbances. Thymeis a flowering plant in the mint (family Lamiaceae). Thymus is a widely used medicinal plant in food and pharmaceutical industries. Among different species of Thyme, Thymus vulgaris is used more than other species in therapeutic dosage forms. In traditional medicine Thymus vulgaris is cultivated in many countries by most people especially in rural areas depend on herbal medicines to treat many diseases including inflammation-related ailments such as rheumatism, muscle swelling, insect bites, pains, etc. Also, the modern medicine in essential oil of Thyme has demonstrated the compounds have shown anti-inflammatory, immunomodulatory, antioxidant, antibacterial and antifungal properties, (Saleh, et al, 2015). Ascorbic acid is not considered a required dietary nutrient, but under certain adverse environmental conditions, the metabolic need for this vitamin may exceed the inherent biosynthetic ability of ascorbic acid (Abou-Ashour, et al., 2004). However, many additives are recently added to rabbit feed or water to help alleviate adverse to enhance productive performance and immune response of rabbits. The present study was conducted to determine the effects of different levels of Thyme leaves and compare their effects with ascorbic acid on growth rabbits performance, carcass traits, digestibility coefficients of nutrients.

2. Material and Methods

Thirty-six growing rabbits male, 5 weeks old, with initial weights of 776.67±9.71 gm were used for the study. The rabbits were randomly allocated to four treatments groups of 9 rabbits each. Each treatment was further sub-divided into 3 replicates of 3rabbits. Rabbits were housed in wire floor batteries of 45 x 36 x 36 cm and were offered diets for duration of the feeding trial until reaching 13 weeks of age. All animals were kept under similar hygienic conditions. Rabbits were housed in well ventilated block building. Fresh air circulated in the house using exhaust fans. The rabbits were kept within a cycle of 16 h light and 8 h dark. Four pelleted diets were prepared. Group one fed control diet free of feed additives and served as a control group. Group 2 and 3 supplemented with 200 and 400 mg Thyme leaves / kg diet, respectively (Purchased from local market). Group 4 received control diet, but drinking water supplemented with 200 mg ascorbic acid /L (Fisher chemical analytical reagent Grande). Fresh water was automatically available at all times through stainless steel nipples for each cage. The experimental diets were offered to rabbits *ad libitum*. The formula of basal experimental diet is presented in Table (1) that formulated to cover the requirements of rabbits according to National Research Council (NRC, 1977) specific for rabbits**.** Individual body weight and feed consumption were recorded weekly. Body weight gain and feed conversion ratio were also calculated.

At the end of the feeding trial, 5 rabbits were selected from each treatment group randomly, starved of food but not water for 12 hours and slaughtered for carcass analysis and the digestibility coefficients of nutrients =100 x (intake - excreted)/intake,

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As shown in Table (4). The results were expressed as the mean ± SEM. All data were analyzed using one way analysis of variance (ANOVA) using SPSS 16.0 statistical software (SPSS, 2008). Significant differences between means were detected. using new Duncan multiple range test (Duncan, 1955):

Data were analyzed by using the following model:

$Yij = \mu + \alpha i + eij$

Where:

Yij = an observation,

αi = treatment effect (i=1,….,6)

eij = random error

Table (1) Composition (%) and chemical analysis of the basal Experimental diet

Ingredients	Basal diet %
Corn yellow	19.00
Wheat bran	11.00
Barley	17.20
Berseem hay	33.00
Soybean meal 44%	15.00
Molasses	3.00
Di-Calcium phosphate	1.00
Lysine	0.10
Methionine	0.10
Vitamins and mineral premix[1]	0.30
Salt	0.30
Total	100
Chemical analysis (%)	
Dry matter	92.96
Organic matter	84.83
Crude protein	17.29
Crude fiber	13.50
Ether Extract	2.80
Ash	8.12
NFE*	51.24
NDF	37.79
DE**kcal/kg	2504.50

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3. Results and Discussion

In the present study the experimental rabbits looked apparently healthy and no mortality was recorded. The effect of Thyme and ascorbicacid on the performance of growing rabbits is presented in (Table 2). The results showed that the supplementation of 200 mg ascorbicacid, 200 and 400 mg Thyme leaves /kg diet brought a significant ($P \leq 0.05$) improvements in final body weight(g) by the value of 2119.4, 2250, 2360.6 and 2232.8, total of weight gain(g) by 1341.7,1502.8,1584.4 and 1457.2 feed conversion ratio by 3.83,3.22,2.96 and 3.43 and significantly ($P \leq 0.01$) decreased daily feed intake(g) by 91.42,86.78,86.77 and 90.2, respectively, in comparison with control. A part of the improvement in growth of rabbits obtained attributed to the positive impact of Thymeon body weight gain BWG and feed conversion ratio FCR due to its antioxidant properties and phenolic compounds. Just like feed intake, BWG also depends on several factors like genotype, housing, hygienic conditions, management, feeding system and diet attributes. Additives feeding have been shown to increase BWG by their ability to destroy pathogen microorganisms in the digestive system and consequently increasing the production of digestive enzymes which improve utilization of digestive products. (Cross, et al. 2007) reported a significant improvement in BWG when supplementing 1 g/kg of Thyme, and when 10 g/kg of the corresponding herb was fed, it was noticed that Thymeherb did not achieve the same positive results as its essential oil. Nevertheless, Another study showed that an addition of 5 g/kg Thyme herb improved BWG by approximately when compared to the corresponding control group (Toghyani, et al.2010). While found (Cross, et al.2007) Addition of 100 mg/kg thymol, the major component of Thyme, did not show any effects on BWG when compared to the control treatment. (Vahid, et al.2012) concluded the addition of 1 g/kg Thyme essential oil might offer some beneficial effects on Japanese quail to increase live body weight. The feed conversion ratio FCR describes the relation of feed intake and BWG. More precisely, it is the animal's overall efficiency in converting feed mass into body mass over a specific period of time (Toghyani, et al.2010) discovered that Thyme herb at an inclusion level of 10 g/kg downgraded FCR by approximately 4%, (Bolukbasi, et al. 2006) found changed FCR beneficially when used 100 and 200 mg/kg of Thyme.(Gerencser, et al.2012) stated Thyme had no effect on the rabbits' weight gain, body weight, feed consumption, but found Significant differences were only for feed conversion ratio. Feed conversion ratio was not influenced by dietary Thyme supplementation (Benlemlih, et al., 2014). (Denli, et al,2004) Concluded when addition of 60 mg/kg of Thyme oil to quail diets significantly improved the body weight gain and feed conversion of quails. (Yasser et al.2015) demonstrated that daily body weight gain and feed conversion ratio of rabbits fed They were significantly improved in compared to the control diet. Also (Al Shanty 2003) showed that ascorbic acid (100ml/1L water) significantly improved final body weight and numerically decreased feed intake when compared with the control. (Selim et al. 2004) cleared those rabbits had access to extra levels of ascorbic acid beyond recommendation level achieved better

performance in weight gain and feed conversion ratio compared to the control group. In addition, (Selim, et al.2008) cleared that the treated growing rabbits with 200 ppm of ascorbic acid recorded significantly the best feed conversion ratio (2.68 vs. 3.68 in control group). Also (Zeweil, et al. 2016) indicated that the treatment with ascorbic acid (200 mg/kg) resulted in no significant increase in body weight, body weight gain and feed intake of rabbits. Based on the obtained results, doe rabbits which received ascorbic acid in drinking water 50 mg/rabbits/day were improvement feed intake (Abu El-Hamd, et al,. 2013). Feed conversion efficiency was better for 150 and 200 ascorbic acid than for 100 and 250 ascorbic acid. Performance of weaned Hyla rabbits could be improved during the hot period by supplementing 150- 200 mg ascorbic acid in water (Dauda, et al. 2015).

Table (2) Productive performance of growing Rabbits fed the experimental diets (Means ± SE).

Items	Dietary treatments			
	Control	Thyme leaves 200mg/kg	Thyme leaves 400mg/kg	Ascorbic Acid 200mg/l
Initial weight (g)	777.78±12.50	777.22±17.48	776.11±23.27	775.56±25.46
Final weight (g)	2119.40^{c} ±41.90	2280.00^{ab}±22.23	2360.60^{a}±15.05	2232.80^{b} ±30.58
Total weight gain (g)	1341.70^{c}±45.30	1502.80^{b}±24.86	1584.40^{a}±21.03	1457.20^{b}±10.00
Daily gain (g)	23.95^{c}±0.80	26.83^{b}±0.44	28.29^{a}±0.37	26.02^{b}±0.17
Daily feed Intake (g)	91.42^{b}±0.48	86.78^{a}±0.26	86.77^{a}±0.39	90.22^{b}±0.62
Feed conversion ratio	3.85^{a}±0.14	3.22^{b}±0.05	2.96^{c}±0.04	3.43^{b}±0.01

a, b, Values in the same row with different superscripts differ significantly (P≤ 0.05)

(Table 3) Results for pre-slaughter weight(g) 2322,2462,2507and 2367 was significantly affected ($P \leq 0.05$) by different treatments in comparison with control. Results for percentage of hot and cold carcass, total edible parts, non-edible parts, giblets, liver, heart, kidneys, spleen, colon, caecum, small intestine, testes, thyroid gland and head and length of small intestine, caecum and colon were insignificantly affected by different treatments, however, kidney fat(%)0.34, 0.32,0.316,0.32and lungs(%)0.56,0.62,0.62,0.58 percentage were significantly ($P \leq 0.05$) decreased and increased, respectively, in the group received 400 mg Thyme in comparison with control. (Abd El-Hamid 1999) reported that carcass percentage, dressing hot carcass weight, kidney and spleen were not significantly affected by the treatment by ascorbic acid of heat-stressed rabbits. (Selim, et al. 2004) reported that ascorbic acid (300 mg/kg diet) did not significantly affect total edible parts (%). Similar results obtained by (Selim, et al. 2008).

(Abou-Zeid, et al. 2000) demonstrated the effect of ascorbic acid supplementation on relative organs weight of Japanese quail at 6 weeks of age, and reported that ascorbic acid supplementation (200 or 300 mg ascorbic acid / liter) had significant effect on the relative weight of liver, spleen and heart while kidney was not affected significantly. Aromatic plants are becoming more important due to their antimicrobial effects and the stimulating effect on animal digestive systems (Ciftci, et al., 2005). (Al-Shanty (2003) found insignificant effect due to ascorbic acid supplementation on carcass traits of

rabbits exposed to heat stress. Also, other studies carried out by(Selim, et al. 2004 , 2008) reported no effect of ascorbic acid on carcass traits of rabbits.

Table (3) Means ± SE of effect of Vitamin .C, Thyme on carcass characteristic of growing rabbits.

	Dietary treatments			
	Control	Thyme leaves 200mg/kg	Thyme leaves 400mg/kg	Ascorbic Acid 200mg/l
Pre-slaughter weight(g)	2322.00b±19.84	2462.00a±11.13	2507.00a±25.57	2367.00b±21.88
Hot carcass %	56.59±0.18	56.78±0.46	56.28±0.17	56.78±0.29
Cold carcass %	54.21±0.35	55.81±0.49	55.31±0.35	55.43±0.41
T Edible parts %	61.01±0.20	61.09±0.55	60.14±0.23	61.16±0.35
Non-Edible parts %	38.98±0.20	38.90±0.55	39.85±0.23	38.83±0.35
Giblets %	4.39±0.06	4.12±0.14	4.35±0.05	4.37±0.14
Kidney %	0.64±0.01	0.65±0.01	0.62±0.01	0.62±0.01
Kidney fat %	0.34±0.01	0.32±0.03	0.316±0.04	0.32±0.01
Heart %	0.33±0.02	0.39±0.01	0.36±0.01	0.31±0.02
Liver %	3.42±0.06	3.07±0.14	3.35±0.07	3.43±0.15
Lungs %	0.56b±0.01	0.62a±0.01	0.62a±0.01	0.58b±0.01
Head %	5.50±0.09	5.24±0.13	5.17±0.13	5.14±0.14
Small intestine (cm)	258.00b±3.74	286.00a±60	292.00a±5.83	262.00b±6.63
Small intestine %	4.13a±0.04	3.98b±0.02	3.94b±0.05	4.14a±0.03
Colon length(cm)	38.00±1.22	40.00±0.00	40.00±0.00	39.00±1.00
Colon %	1.25±0.108	1.23±0.05	1.27±0.04	1.26±0.07
Caecum length (cm)	39.00±1.00	40.00±0.00	40.00±0.00	38.00±1.22
Caecum %	4.58±0.17	5.24±0.14	5.27±0.13	5.12±0.36
Spleen %	0.07±0.01	0.07±0.06	0.07±0.04	0.06±0.01
Thyroid gland (%)	0.01±0.03	0.01±0.02	0.01±0.01	0.01±0.01
Testes (%)	0.40±0.02	0.40±0.01	0.40±0.04	0.42±0.01

a, b, Values in the same row with different superscripts differ significantly (P≤ 0.05)

As shown in Table (4), The digestibility coefficients of nutrients =100 x (intake - excreted)/intake, there were no significant differences (P ≤ 0.05) in digestibility coefficients of DM (%)65.66,64.00,63.00,64.33 but decreased in the groups received Thyme in compared with control and ascorbic acid fed groups. Also, digestibility coefficients of OM (%)58.09,57.29,56.06,57.90 were not insignificantly show the same trend (P ≤ 0.05) as mentioned for DM but group had 400 mg Thyme was numerically less in compared with control and ascorbic acid fed group. On the other hand, CP, EE, CF and NFE were insignificantly affected by ascorbic acid or Thyme supplementation in compared with the control, also results presented showed that feeding diets containing Thyme caused significant (P ≤ 0.05) increment in DCP % value compared with control and ascorbic acid fed group. The present results are in agreement with those reported by (Attia, et al. 2015) said that supplementing heat-stressed laying hens with ascorbic acid improved productive performance compared to the control group. Digestibility of dry matter, organic matter, crude protein and ether extract were highest in the treated treatments and lowest in the control group. Also,

(Selim, et al. 2004) reported that ascorbic acid (300 mg / kg diet) did not significantly affect crude protein digestibility coefficient, while it was significantly affected organic matter, ether extract and crude fiber digestibility coefficients. Sallam, et al. (2005) and Ettaib (2015) indicated that the treatment with ascorbic acid resulted in no significant increase in nutritive values of the experimental diets. Selim, et al. (2004) reported that the treat ascorbic acid (300 mg/kg diet) did not significantly affect crude protein (CP) digestibility coefficients (%), while, it was significantly affected organic matter (OM), ether extract (EE) and crude fiber (CF) digestibility coefficients (%). While, (Sallam, et al.2005) indicated that the treatment with ascorbic acid (40 mg/kg body weight) resulted insignificant increase in digestibility coefficients (DM, OM, CP, CF, EE and NFE) and TDN. On the same trend,(Skrivanova and Marounek 1997) reported that the digestibility of nutrients of Hyla 2000 rabbits supplied with ascorbic acid at 30 mg/kg body weight twice a week was not significantly affected. Supplementing heat-stressed laying hens with ascorbic acid improved productive performance compared to the control group. Digestibility of dry matter, organic matter, crude protein and ether extract were highest in the treated treatments and lowest in the control group (Attia, et al. 2015).In conclusion the results showed that addition of Thyme and ascorbic acid in rabbit diets had improved the productive performance, carcass, digestibility of growing rabbits and 400 mg/kg Thyme was more effective tan 200 mg/kg Thyme and ascorbic acid.

Table (4) Means ± SE of effect of Vitamin .C, Thyme on digestibility coefficients of nutrients and nutritive values.

Items	Dietary treatments			
	Control	Thyme leaves 200mg/kg	Thyme leaves 400mg/kg	Ascorbic Acid 200mg/l
DM (%)	65.66^{a}±0.33	64.00^{a}±0.57	63.00^{a}±0.57	64.33^{a}±0.33
OM (%)	58.09^{a}±0.43	57.29^{a}±0.32	56.06^{a}±0.34	57.90^{a}±0.60
CP (%)	74.20±0.10	75.21±0.35	75.57±0.10	74.89±0.39
EE (%)	62.57±0.30	63.02±0.50	63.39±1.45	61.35±0.35
CF (%)	31.53±0.28	32.51±0.58	32.94±0.23	32.25±0.13
NFE (%)	51.26±0.01	50.73±0.07	50.99±0.23	51.50±0.25
DCP (%)	12.82^{a}±0.01	13.13^{b} ±0.06	13.24^{b} ±0.01	12.94^{a}±0.06
TDN (%)	72.27±0.07	72.56±0.13	72.87±0.07	72.85±0.06

a, b, Values in the same row with different superscripts differ significantly (P≤ 0.05)

4. Conclusion

Each The results obtained from this study showed that the second group (200 mg Thyme leaves / kg diet) and the third group (400 mg Thyme leaves / kg diet) is safe and better than the Group one fed control diet free andGroup four 200 mg ascorbic acid /Lthe and results showed that addition of Thyme leaves or ascorbic acid in rabbit diets had improved the productive performance, carcass, digestibility of growing rabbits and 400 mg/kg Thyme leaves was more effective tan 200 mg/kg Thyme leaves or ascorbic acid.

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تأثير إضافة مسحوق الزعتر وحمض الاسكوربك كمنشطات نمو طبيعية على معدل الأداء ، وخصائص الذبيحة للأرانب النامية

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الملخص

أجريت هذه الدراسة لمعرفة تأثير إضافة مسحوق الزعتر وحمض الاسكوربك كمنشطات نمو طبيعية على معدل الأداء ، وخصائص الذبيحة للأرانب النامية, أستخدم 36 أرنب ذكر نامي بعمر 5 أسابيع ومتوسط وزن ابتدائي 776.67±9.71 جرام تم توزيعها عشوائيا على 4 معاملات وبكل معاملة 9 أرانب مقسمة الى 3 مكررات كل مكرر 3 أرانب , استمرت التجربة حتى عمر 13 أسبوع . المجموعة الأولى تناولت عليقه أساسية خالية من الإضافات الغذائية واستخدمت كمجموعة مقارنة .المجموعتان الثانية والثالثة تناولت عليقه أساسية مضاف إليها أوراق الزعتر المطحونة بمعدل 200 , 400 مليجرام /كيلوجرام على التوالي, المجموعة الرابعة تناولت العليقة الأساسية مع إضافة 200 مليجرام/لتر من حمض الاسكوربك لمياه الشرب . كانت جميع العلائق التجريبية متساوية في البروتين والطاقة .أظهرت النتائج إن إضافة 200 مجم من حامض الاسكوربك ، 200 و 400 ملغ من أوراق الزعتر/ كغم أدى إلى تحسن كبير ($P \leq 0.05$) في وزن الجسم النهائي بقيمة 2250,2119.4 , 2360.6 و 2232.8 جم بالوزن, في حين بلغ معدل التحصيل الغذائي 1341.7, 1584.4 1502.8, و 1457.2ونسبة تحويل الأعلاف 3.83,3.22, 2.96 , 3.43 ومن النتائج هناك انخفاض بشكل ملحوظ في كمية العلف المستهلك بنسبة 91.42, 86.78, 86.77 ,90.2 على التوالي. معظم صفات الذبيحة تأثرت بشكل غير معنوي من قبل الإضافات المختلفة ، ومع ذلك انخفضت نسبة الدهون في الكلى في حين زاد الوزن النسبي للرئتين بشكل كبير ($P \leq 0.05$) على التوالي ، وزادت في المجموعة التي تلقت 400 ملغ من أوراق الزعتر بالمقارنة مع السيطرة. معاملات الهضم DM انخفضت معنويا ($P \leq 0.05$) في المجموعات التي أضيفت لها أوراق الزعتر ومع ذلك كان معاملات الهضم في OM للمجموعة التي تحتوي على 400 مجم من أوراق الزعتر بالمقارنة مع مجموعة السيطرة ومجموعات حمض الاسكوربك, الإضافات المحتوية على أوراق الزعتر سببت في زيادة معنوية ($P \leq 0.05$) في القيمة٪ DCP مقارنة مع مجموعة السيطرة ومجموعات حمض الاسكوربك. في الختام أوضحت النتائج أن إضافة أوراق الزعتر وحمض الأسكوربك في تغذية الأرانب قد حسنت من الأداء الإنتاجي ، الذبيحة ، قابلية الهضم الأرانب النامية و 400 ملغم / كغم من أوراق الزعتر كانت أكثر فعالية من 200 ملغم / كغم من أوراق الزعتر أو حمض الأسكوربك.

الكلمات المفتاحية : الأرانب – أوراق الزعتر – حمض الاسكوربك – معدل الأداء .