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RESPONSE TO DIETARY SUPPLEMENTATION WITH TURMERIC (*CURCUMA LONGA*) POWDER ON GROWTH PERFORMANCE AND MEAT QUALITY OF RABBITS

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ABSTRACT

The current study compared the effect of dietary inclusion of potential antioxidants (vitamin E *vs*.turmeric powder) on growth performance, dressing percentage and some physico-chemical characteristics of refrigerated loin meat stored at 4°C for 6 days. Eighty 5-week-old New Zealand White rabbits were equally distributed among 4experimental treatments and fed on diets with one of the following supplements per kg diet for 8 weeks: Control (a basal control diet; 60mg vitamin E), 100mg vitamin E, 200mg or 400mg turmeric powder). Results indicate that live weight gain (WG) and hot dressing percentage were significantly higher (p=0.001 and p=0.002, respectively) in both turmeric supplemented groups compared to the control and 100mg vitamin E groups. Feed conversion ratio (FCR) was significantly improved (p=0.001) in all antioxidants supplemented groups compared to the control. Supplementation of turmeric powder at 200mg/kg improved WG, FCR and dressing percentage by 20.81%, 12.40% and 3.24%, respectively over the control. Chemical composition of the meat, especially in terms of higher crude protein and lower ether extract contents was significantly approved with turmeric feeding. Also, rate of oxidative rancidity of loin meat was significantly reduced with turmeric feeding at 1, 3 and 6 days following refrigerated storage. It could be recommended to fortify growing rabbit diet with turmeric powder at the rate of 200mg/kg diet to improve the growth performance and oxidative stability of refrigerated meat.

Key words: Rabbit, vitamin E, turmeric, growth performance, meat oxidative stability.

INTRODUCTION

Natural antioxidants are accepted more readily by consumers than synthetic ones. The supplementation of vitamins, mainly vitamin E has been studied in rabbit diets, but, in most cases, no statistically significant difference on the growth performance has been observed. However, supplementation reduced problems of lipid oxidation in meat (Abdel-Khalek, 2013).These beneficial effects obtained from aromatic plants promote an improvement in the productive performances, health status and meat quality of rabbits. However, variations in their active compounds between plant species are a point that deserves major consideration (Kovitvadhi, 2015). Turmeric (curcuma) powder is a rich source of beneficial phenolic groups, called the curcuminoids, where three main curcuminoids, curcumin, demethoxycurcumin and bis-demethoxycurcumin have been isolated from turmeric (Földešiová, 2015). These active components have the ability to inhibit the lipid oxidation and can scavenge the harmful free radicals (Cousins *et al.* 2007).
High doses of turmeric; up to 0.6% of the diet, had no significant effect on growth performance of rabbits. However, supplementation lowered lipid oxidation in liver (Alagawany *et al*. 2015). On low supplementation doses, Földešiová *et al.* (2015) reported that supplementation of turmeric powder at 5 g/100 kg growing doe rabbit diet improved live weight gain compared to the control or supplementing with turmeric powder at 20 g/100 kg. Under summer conditions, Basavaraj*et al.*

(2018**)** indicated no beneficial effect of dietary inclusion of turmeric rhizome powder at 0, 0.15 and 0.30% on meat characteristics of growing rabbits. Under high supplementation level, Abd El-Latif *et al.* (2019) reported that growth performance of rabbits fed dietary turmeric powder at 0.5% of the diet did not significantly differ from the control.
This study aimed to investigate the effect of dietary supplementation with vitamin E or turmeric powder on growth performance and some carcass quality traits of growing rabbits.

MATERIALS AND METHODS

Treatments, feeding, management, slaughtering, and meat quality measurement protocol

Eighty 5-week-old NZW rabbits were equally distributed among 4 experimental treatments and fed on diets with one of the following supplements per kg diet for 8 weeks: control (a basal control diet; 60mg vitamin E), 100mg vitamin E, 200mg or 400mg turmeric powder. Vitamin-mineral premixes were adjusted according to studied vitamin E levels. The basal diet was formulated to satisfy the NRC (1977) recommendations. Rabbits were kept under the same managerial routine. For assessment of hot dressing percentage, six rabbits of each treatment were assigned according to Blasco and Ouhayoun (1996). Also, rate of lipid oxidation in terms of thiobarbituric acid-reactive substance (TBARS) test was carried out according to AOAC (1990) in refrigerated loin meat muscles (4°C) at 1, 3 and 6 days using six samples of each treatment. pH of the meat was measured at 24 h *post-mortem* (pH_{24};pHu) at the level of 13^{th} thoracic rib by a CrisonMicropH 2001 (Crison Instruments, Spain) using a combined electrode penetrating 3 mm. The proximate chemical composition in terms of DM, CP, EE and ash of loin meat were analysed according to AOAC (2000) after 24 h of refrigerated storage at 4°C was carried out using 6 samples of each treatment.

Statistical analysis

Data were subjected to a one-way ANOVA using SAS (2001). Variables having significant differences were compared using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Growth performance and dressing percentage

Results in Table 1 indicate the effect of dietary supplemental antioxidants (vitamin E and turmeric) on growth performance and hot dressing percentage of the rabbits. It is clear that total live weight gain (WG) (g) was increased and feed conversion ratio (FCR) was improved significantly as both supplemental vitamin E and turmeric powder were included in the diets. However, the improvement was more pronounced with turmeric supplementation, especially in case of the lower turmeric level (200mg/kg diet). The WG and FCR were improved by 20.2% and 12.4%, respectively in 200mg/kg diet turmeric powder *vs.* the control and this improvement was associated non-significant increase in feed intake (+5.01 over the control).Hot dressing percentage was significantly affected by turmeric powder supplementation and not by supplemental vitamin E. These results agree with El-Medany *et al.* (2012) reporting significant response to vitamin E inclusion (120 *vs.* 40 mg/kg diet) on WG and FCR but not dressing percentage of rabbits. Whereas, Szendrő *et al.* (2012) and Cardinali *et al.* (2015) reported no additional response to vitamin E on growth performance or carcass traits of rabbits. Also, results agree with Földešiová *et al.* (2015) that turmeric powder in rabbit diet improved WG. But current results conflict with Basavaraj *et al.* (2018) and Abd El-Latif *et al.* (2019) who reported that turmeric exerted no additional significant effect on growth performance of rabbits. The extra growth promoting effect of turmeric beyond vitamin E effect could be attributed to that the plant has shown topossess high antioxidant, antibacterial, digestive and anti-inflammatory properties as reported by Földešiová *et al.* (2015).

Table 1: Effect of dietary antioxidant supplements on growth performance and dressing percentage of rabbits.

Variable / Supplement (per kg diet)	Initial live weight (g)	Total live weight gain (g)	Total feed intake (g)	Feed conversion ratio	Dressing percentage
Control	596	1,180[c]	4,468	3.79[b]	55.4[b]
Vitamin E (100mg)	607	1,256[b]	4,300	3.43[a]	54.6[b]
Turmeric (200mg)	593	1,418[a]	4,692	3.32[a]	57.2[a]
Turmeric (400mg)	585	1,398[a]	4,726	3.38[a]	58.9[a]
Pooled SE	54	75	455	0.31	1.39
P- value	0.752	0.001	0.061	0.002	0.029

[a, b] different superscripts within a column indicate significant differences.

Meat quality

Results in Table 2 indicate that chemical composition of the meat was significantly improved with turmeric supplementation compared to the supplemental vitamin E or control groups. Meat content of DM, CP was increased, while EE and ash contents decreased in turmeric fed rabbits. No clear reasons for the effect of turmeric on meat chemical composition. Meat pHu (pH_{24}) was not affected by dietary treatments. The anti-oxidative potency of supplemental turmeric powder is clear throughout the 6-day study of refrigerated storage over supplemental vitamin E or the control. Corino *et al.* (2007) reported that supplemental antioxidant TOH had no effect on loin muscle pH. A few studies have been conducted to explore the active components of essential oils with antioxidant properties in the rabbit (Abdel-Khalek, 2013). Polyphenolic compounds in chestnut tannins significantly reduced TBARS in rabbit meat (Gai *et al.* 2009). Also, it was reported that dietary turmeric powder reduces the oxidative reactions in the body of broiler chicks and the rate of lipid peroxidation of the meat (Kanani *et al.* 2017).

Table 2: Effect of dietary antioxidant supplements on meat quality of rabbits.

Variable / Supplement (per kg diet)	Meat chemical composition (%)				pHu	TBARS (mg MDA/kg meat)		
	DM	CP	EE	Ash		Day 1	Day 3	Day 6
Control	23.6[ab]	21.7[c]	5.1[a]	1.32[a]	5.78	0.556[a]	1.385[a]	1.842[a]
Vitamin E (100mg)	23.5[b]	22.1[bc]	4.9[a]	1.29[a]	5.71	0.505[ab]	1.273[a]	1.286[b]
Turmeric (200mg)	23.8[a]	22.9[a]	4.1[c]	1.23[ab]	5.98	0.496[b]	1.071[b]	1.025[b]
Turmeric (400mg)	23.8[a]	22.7[ab]	4.5[b]	1.17[b]	6.01	0.477[b]	1.011[b]	1.040[b]
Pooled SE	*0.18*	*0.59*	*0.25*	*0.09*	*0.27*	*0.033*	*0.091*	*0.122*
P- value	*0.031*	*0.007*	*0.001*	*0.05*	*0.095*	*0.027*	*0.006*	*0.001*

[a, b,c] different superscripts within a column indicate significant differences.

CONCLUSIONS

The findings of the present study suggest supplementing the rabbit diet with 200mg/kg diet of turmeric powder to improve the growth performance and oxidative stability of refrigerated rabbit meat.

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