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RESPONSE TO DIETARY SUPPLEMENTATION WITH *ARTEMISIA ANNUA* POWDER ON GROWTH PERFORMANCE AND MEAT QUALITY OF RABBITS

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ABSTRACT

The interest in phytogenic feed additives has been increased in rabbit nutrition since the ban of antibiotic as growth enhancer.The current study compared the effect of dietary inclusion of potential antioxidants (vitamin E *vs.*artemisia 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 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; none (a basal control diet; 60mg vitamin E), 100mg vitamin E, 200mg or 400mg artemisia powder). Results indicate that live weight gain and hot dressing percentage were significantly (p=0.001 and 0.035, respectively) higher in both turmeric supplemented groups compared to the control and 100mg vitamin E groups. Feed conversion ratio was significantly (p=0.001) improved in all antioxidants supplemented groups compared to the control. The 200mg/kg diet of artemisia powder group had more 21.36, 3.61 and 14.78% better live weight gain, dressing percentage and feed conversion ratio, respectively than the control group. Chemical composition of the loin meat, especially in terms of higher crude protein and lower ether extract contents was significantly affected with artemisia at the rate of 200mg/kg diet. Also, rate of oxidative rancidity of loin meat was significantly reduced with artemisia feeding at 1, 3 and 6 days following refrigerated storage, irrespective of supplementation rate. It could be recommended to fortify growing rabbit diet with artemisia powder at the rate of 200mg/kg diet to improve the growth performance and oxidative stability of refrigerated meat.

key words: Rabbit, vitamin E, artemisia, growth performance, meat oxidative stability.

INTRODUCTION

Artemisia is a vigorous growing annual weedy herb. The plant produces bioactive compounds including flavonoids, coumarins, steroids, phenolics, monoterpenoids, triterpenoids and sesquiterpenoids. The most important of the sesquiterpenoids seems to be artemisinin, dihydroartemisinic acid and artemisinic acid (Ferreira and Janick, 1995). In addition to these anti-oxidative components, artemisia species also have high concentrations of essential oils that are useful in the maintenance of a favourable micro-floral balance and reduces methane production, which collectively increases feed efficiency (Greathead, 2003). Also, it is well know its anti-protozoal, anti-bacterial and antioxidant activities of the plant, its extracts, and its essential oil (Albert *et al.* 2010).

There is scarcity in rabbit studies dealing with the effect of artemisiaongrowth performance and meat quality. Abousekken *et al.* (2015) reported that growth performance, in terms of feed conversion ratio and performance index was significantly improved in *Eimeria*oocyst infected rabbits treated with 2.5 ml of*artemisiaannua*extract3 times a week/rabbit. In broiler chicks, Cherian*et al.* (2013) reported that

feeding broiler chickens with *artemisia annua* resulted in a significant reduction in TBARS value in breast and thigh meat. Ait-Kaki *et al.* (2018) reported a significant increased in live body weight in broiler chicks fed a diet supplemented with 0.2% artemisia but there was no significant difference in feed conversion ratio or percentage carcass yield.

This study aimed to investigate the effect of dietary supplementation with vitamin E or artemisia 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; none (a basal control diet; 60mg vitamin E) 100mg vitamin E, 200mg or 400mg artemisia powder. Vitamin-mineral premixes were adjusted for the 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 thio-barbituric 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 reveal the effect of dietary supplemental antioxidants (vitamin E and artemisia) 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 artemisia powder were included in the diets. However, the improvement was more pronounced with artemisiasupplementation, especially in case of the lowerartemisia level (200mg/kg diet). The WG and FCR were improved by 21.36% and 14.7%, respectively in 200mg/kg diet artemisia powder *vs.* the control. This improvement was associated non-significant increase in feed intake (+3.79% over the control). There were significant feed intake differences between the experimental groups, where the group on artemisia at 400mg/kg diet had the highest value and the group on 100mg vitamin E had the lowest value.Hot dressing percentage was significantly increased with in artemisia fed groups *vs.* both in supplemental vitamin E group and the control. 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.Unfortunately, the literature on livestock response to artemisia supplementation is scarce. Abousekken *et al.* (2015) reported that growth

performance, in terms of feed conversion ratio and performance index was significantly improved, although in that study artemisia was provided to treat *Eimeria*infection in rabbits. The improvement seen in live performance of the rabbits in the current study with artemisia supplementation over supplemental vitamin E or the control may be attributed to the comprehensive properties that artemisia possess including the antioxidant function. In this regard, Greathead (2003) pointed out that artemisia has high concentrations of essential oils that are useful in the maintenance of a favourable micro-floral balance. Moreover, Albert *et al.* (2010) affirmed the anti-protozoal and anti-bacterial role of artemisia that could results in further improvement in animal performance.

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	569	1180^{c}	4458^{bc}	3.79^{c}	55.4^{b}
Vitamin E (100mg)	607	1256^{b}	4300^{c}	3.43^{b}	54.6^{b}
Artemisia (200mg)	576	1432^{a}	4627^{ab}	3.23^{a}	57.4^{a}
Artemisia (400mg)	579	1401^{a}	4726^{a}	3.37^{b}	57.1^{a}
Pooled SE	*57*	*77*	*282*	*0.18*	*1.38*
P- value	*0.411*	*0.001*	*0.001*	*0.001*	*0.035*

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

Carcass quality of meat

Results in Table 2 indicate that chemical composition of the loin meat in terms of crude protein and ether extract contents was significantly improved with artemisiasupplementation only, at the low dose compared to the supplemental vitamin E or control groups. Meat content of dry matter or ash was not significantly affected by supplements under study. Meat pHu (pH_{24}) was not affected by dietary treatments. The anti-oxidative potency of supplemental artemisia powder is clear throughout the 6 day study of refrigerated storage over supplemental vitamin E or the control.Corino *et al.* (2007) reported thatSupplemental 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). Oxidative stability of the loin meat was significantly increased with artemisia feeding, where the rate of lipid rancidity was reduced at 1, 3 and 6 days following refrigerated storage in groups of artemisia, irrespective of supplementation rate. In this connection, Cherian*et al.* (2013) reported that feeding broiler chickens with a*rtemisia annua* resulted in a significant reduction in TBARS value in breast and thigh meat. They suggested that the reduction in TBARS value could be due to individual or combined antioxidant properties of polyphenolic compounds or vitamin E in *Artemisia annua*.

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	21.7^{b}	5.1^{a}	1.32	5.78	0.556^{a}	1.385^{a}	1.842^{a}
Vitamin E (100mg)	23.5	22.1^{ab}	4.9^{a}	1.29	5.71	0.505^{ab}	1.273^{a}	1.286^{b}
Artemisia (200mg)	23.6	22.3^{a}	4.4^{b}	1.37	6.01	0.394^{c}	0.960^{b}	1.005^{c}
Artemisia (400mg)	23.2	22.7^{b}	4.5^{b}	1.29	5.97	0.453^{bc}	0.960^{b}	1.011^{c}
Pooled SE	0.347	0.478	0.348	0.202	0.31	0.036	0.098	0.127
P- value	0.107	0.017	0.004	0.908	0.314	0.008	0.002	0.001

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

CONCLUSION

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

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