EFFECTS OF VITAMIN E ON COLOUR EVOLUTION, LIPID OXIDATION AND FATTY ACID PROFILE IN PORK

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I. INTRODUCTION

Polyunsaturated fatty acids (PUFA) enrichment of pork is considered healthy for humans but is also linked to softer fats and pro-oxidant conditions, which can affect shelf-life. Vitamin E (VE) is the most used antioxidant supplement in animal feed, and in the case of pigs, the reference requirements are rather low compared with other species. This work aimed to assess the effects of two doses of VE (30 vs. 300 IU/kg feed) on colour attributes evolution, storage drip losses, lipid oxidation and fatty acid (FA) profile on pork stored up to 15 days under modified atmosphere packaging (MAP).

II. MATERIALS AND METHODS

At the abattoir, a total of 56 pigs (50% gilts and 50% entire males) with 128.6±10.8kg of body weight and 169±4.5 days of age, were selected from a population of 220 commercial crossbred pigs. Animals were fattened for 39 days and group-penned (0.94±0.16m^2/pig). The pigs ate feed *ad libitum* (2300 kcal net energy/kg feed, 14.63% crude protein, 0.86% Lys) with two doses of VE (30 vs. 300 IU of DL (all-rac)-α-tocopheryl acetate/kg). After slaughtering, all carcasses were chilled for 3 h and a piece of *Longissimus lumborum* was detached (1^{st}-4^{th} lumbar vertebra). Each loin was sliced into five pieces (3-cm thick) and randomly assigned into five possible display times (0, 9, 11, 13 and 15 days). Samples were stored in trays (4 slices/tray) under MAP (80% O_2+20% CO_2) with an absorbent pad and wrapped with a low gas permeability polyvinyl chloride film kept in darkness at 4°C during the display time stipulated. Trays were sequentially opened for meat colour evolution (portable Minolta CM-700d spectrophotometer), storage drip losses and lipid oxidation measurement ([1], expressed as mg of malondialdehyde (MDA)/kg of meat). Meat FA methyl esters (FAMES) were obtained through a two-step methylation procedure [2] using a Bruker SCION 436-GC gas chromatography, equipped with a SP-2560 capillary column (100 m x 0.25 mm x 0.2 µm film thickness), and flame ionization detector as FAMEs. Finally, FAs were identified using several commercial FAMEs standards (Nu-Chek, Elysian, USA) and others following the indications of UNE-EN ISO 12966-4:2015. Also, the α-tocopherol and cholesterol content were analysed [3]. The FAME, α-tocopherol and cholesterol data were analysed in a linear model, and colour parameters and MDA were analysed with a linear mixed model with repeated measures (α=0.05). Linear regression coefficients for MDA and α-tocopherol and PUFA were estimated.

III. RESULTS AND DISCUSSION

Meat colour parameters (L*, a*, b*, C*, H° or estimated metmyoglobin) were not affected by VE. However, meat colour attributes showed effect of the display time; all variables except the H° presented the lowest value on day 0 and increased in the following days ($P<0.001$, Table 1). Drip losses were highest in meat stored for 15 days in MAP ($P<0.001$). The sum of total FA and the FA profile were not affected by diet. As it was expected, animals supplemented with 300 IU/kg of VE showed a higher α-tocopherol deposition than meat from the 30 IU/kg-group ($P<0.001$). Also, cholesterol was higher in pigs supplemented with high levels of VE. The MDA increased linearly with

display time (P<0.05), but its production was not related to the α-tocopherol deposition (Figure 1). Concomitantly, the higher PUFA content the higher MDA production although the R^2 value was low.

Table 1. Effect of day on meat colour parameters and drip loss and vitamin E (30 and 300 IU/kg) on fatty acid profile (expressed as mg FA/100 g of meat), α-tocopherol and cholesterol content.

	Vit E		Display time (d)					SEM	*P*-value	
Items	**30 IU/kg**	**300 IU/kg**	**0**	**9**	**11**	**13**	**15**		**Vit E**	**Day**
L*	53.1	53.4	52.0^{c}	53.7^{ab}	53.4^{b}	53.9^{a}	53.4^{b}	0.25	0.376	<0.001
a*	3.03	2.98	1.16^{c}	3.5^{a}	3.53^{a}	3.60^{a}	3.23^{b}	0.12	0.821	<0.001
b*	7.15	7.33	5.16^{c}	7.30^{b}	7.81^{a}	8.00^{a}	7.91^{a}	0.11	0.218	<0.001
C*	7.81	7.96	5.33^{c}	8.12^{b}	8.58^{a}	8.81^{a}	8.57^{a}	0.13	0.336	<0.001
H°	67.9	68.8	77.7^{a}	64.5^{d}	65.7^{cd}	66.0^{c}	67.8^{b}	0.68	0.460	<0.001
MMb (%)	12.6	12.3	---	10.1^{c}	10.8^{c}	13.2^{b}	15.7^{a}	0.62	0.727	<0.001
Storage drip loss (%)	8.77	8.95	---	8.23^{b}	8.13^{b}	8.28^{b}	10.8^{a}	0.52	0.826	<0.001
Sum of fatty acids (FA)	1311	1372	---	---	---	---	---	0.08	0.611	---
Saturated FA	528	552	---	---	---	---	---	32.1	0.609	---
Monounsaturated FA	493	537	---	---	---	---	---	41.4	0.456	---
Polyunsaturated FA	290	283	---	---	---	---	---	11.8	0.679	---
n6/n3	17.5	17.7	---	---	---	---	---	0.38	0.635	---
α-tocopherol, µg/g meat	3.13	5.60	---	---	---	---	---	0.12	0.001	---
Cholesterol, mg/g meat	0.55	0.62	---	---	---	---	---	0.02	0.009	---

^{a,b,c,d} indicate differences between display days (P<0.05).

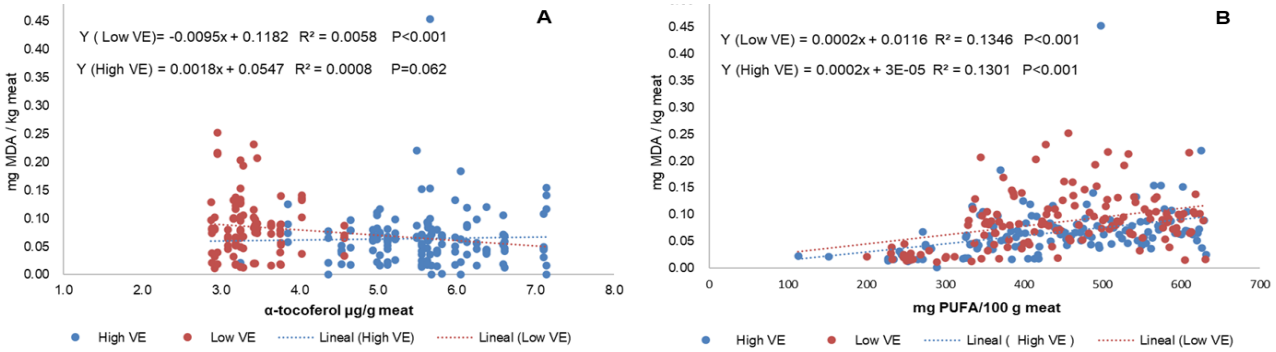

Figure 1. Relation between MDA content and α-tocopherol (A) or PUFA (B) in meat stored up to 15 days.

IV. CONCLUSION

The supplementation of high doses of VE in pig diet does not modify the meat colour parameters and FA profile, but it increases the vitamin E and cholesterol deposition in loins. Lipid oxidization in pork is not decreased by supplementation of 300 IU VE/kg feed.

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