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BIOACTIVE COMPOUNDS AS AN ALTERNATIVE TO VITAMIN E IN BEEF SHELF LIFE

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I. INTRODUCTION

Consumers associate bright red colour with superior meat quality. At retail, beef is commonly displayed under oxygen-enriched atmosphere packaging that ensures the formation of oxymyoglobin, providing an attractive appearance. However, the high level of oxygen enhances oxidative reactions, compromising meat quality. To reduce this negative impact, supranutritional doses of vitamin E are administered in the feed [1], which increases the cost of the ration. Alternatives to the use of α-tocopherol are being studied, characterised by their content of different bioactive compounds. Among them, triterpenes derived from olive pomace have been found to contribute to the prevention of cardiovascular and cardiometabolic diseases [2], in addition to their antioxidant activity [3]. The aim of this trial was to assess the effect of a commercial blend of olive pomace (BOP) on the shelf life of beef by partially substituting the doses of vitamin E in the feed, thereby reducing the cost of the ration.

II. MATERIALS AND METHODS

Two batches of crossbred animals were obtained from a commercial farm that routinely added different additives in the feed of entire males: Treatment 1 (VIT E): 300 mg vitamin E /kg concentrate; Treatment 2 (VIT E+BOP): 150 mg vitamin E + 150 mg BOP /kg concentrate. The BOP contained 40,3 mg maslinic acid /g and 13.6 mg oleanolic acid/g as major terpenes. Animals received the additives for 3 months prior to slaughtering at a licensed abattoir with captive bolt as stunning method, that occurred with 12.4±1.4 mo and 12.9±0.7 mo, and 359±10.5 kg and 380±21.6kg cold carcass weight, respectively for VIT E and VIT E+BOP. At 48h after slaughtering, the knuckle of 8 animals per treatment with normal pH was vacuum packaged and kept at 3 ºC until reaching 16 days of ageing. Then, 6-mm thick steaks were obtained, packaged with 80:20 (O_2:CO_2) modified atmosphere and placed at 4 ºC in a display cabinet for 0, 3, 7 and 10 days with 16 h of continuous light (1200 lx). Colour was assessed with a Minolta CM-600d reflectance spectrophotometer with an illuminant D65 and a 10° standard observer following the CIE L*a*b* system. Lipid oxidation was measured with the TBARS (thiobarbituric acid-reactive substances) method [4]. A 7-member trained taste panel assessed sensory attributes in meat aged for 7 days and grilled at 200 °C until reaching 70 °C of internal temperature, and 18 consumers indicated their visual acceptability at purchase at each time. A General Lineal Model was used with SPSS 29.0 to analyse the data.

III. RESULTS AND DISCUSSION

Redness (a*) and yellowness (b*) followed the same evolution as shown in Figure 1A for Chroma*. The oxygenation of myoglobin at the initial stages of display due to the oxygen-rich atmosphere increased meat colour saturation equally in both treatments during the first three days. In VIT E+BOP treatment, it began decreasing from there onwards. However, in VIT E treatment, Chroma* kept increasing until 7 days of display (P<0.001), decreasing afterwards. No significant differences were found after 10 days of display between treatments, with values above 17 which can be considered a limit for consumer acceptability in young animals reared in feedlot systems [5]. Lipid oxidation increased exponentially throughout display (Figure 1B). No significant differences were found between treatments until 7 days of ageing, when treatment VIT E showed a trend (P<0.1) towards lower lipid oxidation than VIT E+BOP, in both cases below 1 mg malonaldehyde/kg meat. This difference increased after 10 days of display, when VIT E+BOP values were almost 2-fold those of VIT E treatment (2.11 *vs* 1.17, P<0.01)). These results coincide with the sensory perception from the taste panel (Table 1). After 7 days of display, no differences were found in texture or beef odour or flavour between treatments, but rancidity began to be perceived. Rancid odour and flavour were higher in VIT E+BOP meat than in VIT E meat. Coincidentally with the differences found in lipid oxidation at this ageing, this perceived rancidity was low in both treatments, below 3 in odour and 4 in flavour in a 10-point scale. A limit of 2.2 mg malonaldehyde/kg of meat has been considered as the limit of rancidity for beef acceptability [6]. VIT E+BOP meat would almost reach this limiting value after 10 days of display, much higher than VIT E values.

Meat showed a gradual decrease in acceptability over time, maintaining a score above 5 in both treatments after 7 days of display. After 10 fays, VIT E samples had significantly higher acceptability (Figure 1C).

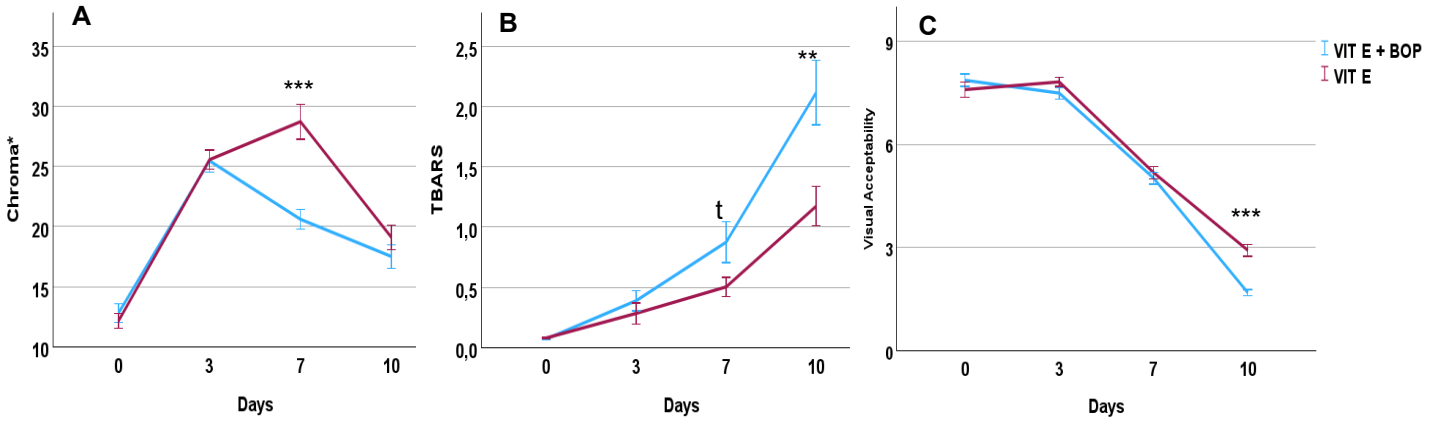


Figure 1. Evolution throughout display for (A)10 days of Chroma*, (B) mg malonaldehyde/kg meat (TBARS) and (C) visual acceptability (0, none-9, high) in meat from animals fed 150 mg vitamin E + 150 mg blend of olive pomace /kg concentrate (VIT E + BOP) or 300 mg vitamin E/ kg concentrate (VIT E). t: *P*<0.1; **: *P*<0.01; *** *P*<0.001.

Table 1. Sensory characteristics of meat from animals fed 150 mg vitamin E + 150 mg blend of olive pomace /kg concentrate (VIT E + BOP) or 300 mg vitamin E/ kg concentrate (VIT E)

	Treatments		SEM	Pr > F
	VIT E + BOP	VIT E		
Beef odour	7.00	6.80	0.15	0.371
Rancid odour	2.98 a	2.45 b	0.24	0.049
Tenderness	6.11	6.34	0.16	0.440
Juiciness	5.46	5.50	0.14	0.900
Beef flavour	6.34	6.41	0.15	0.767
Rancid flavour	3.54 a	2.63 b	0.24	0.002

0.1, very low – 10, very high. a, b: Values are significantly different. SEM: Standard Error of the Mean.

IV. CONCLUSION

The partial substitution of vitamin E with a blend of olive pomace in the feed of beef could serve as a cost-effective alternative in markets where meat can be sold with a few days of display. However, this approach is not recommended for meat displayed for more than 7 days, as it is less effective in preventing oxidation compared to higher doses of vitamin E. Further studies in this area are necessary to provide robust recommendations for the industry.

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