PE8.33 Effect of Diet Supplementation on Lamb Meat Quality 358.00

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Abstract— **The effect of diet supplementation (DS) (Vitamin E or flavonoids) in different concentrations on lamb meat quality was evaluated throughout a period (0, 4, 7, or 10 days of display; D) in modified atmosphere packaging starting at 48 hours postmortem. At each display time, colour, pH, and oxidation were measured on loin chops (*Longissimus dorsi* muscle) following standard methods. Colour was little or no affected by DS, and there was a similar trend throughout D. pH values were within the normal average values being rather stable. In contrast, DS had a strong effect on lipid oxidation. A significant increase on lipid oxidation values throughout display was shown, where both DS showed a clear antioxidant effect compared to control treatment. At 4 d of display, flavonoid supplementation had higher antioxidant effect than 100 ppm vitamin E and similar as the effect of higher vitamin E doses.**

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***Index Terms*— flavonoids, vitamin E, colour, oxidation, display**

I. INTRODUCTION

Meat appearance plays an important role on consumer acceptance and purchase, as visual appearance is the only tool that consumers have to make a purchase decision. Besides, meat colour is considered one of the most important factors that influence consumer decision, where a red bright colour is associated with freshness.

Throughout time, changes in meat colour appear where red meat becomes brown, due to metmyoglobin formation [1]. This fact is related to pigment oxidation and microbial growth.

To preserve colour and lipid stability, diet supplementation with antioxidant substances is a main strategy. Vitamin E has a known antioxidant effect on colour stability [2], but it is not the only compound that has this effect. Flavonoids are natural substances which have been described to preserve colour and lipid oxidation [3].

The objective of this study was to evaluate whether flavonoid or vitamin E supplementation on diet had a benefit on colour and lipid stability in lamb meat.

II. MATERIALS AND METHODS

Fifty lambs of Rasa Aragonesa breed (local meat purpose breed) were divided into 5 batches, depending on diet supplementation (DS): 3 batches with vitamin E (100, 200 or 300 ppm, respectively), 1 batch with EVENCIT® (150 ppm), and a control group without supplementation. Animals were reared intensively and fed with concentrate with the correspondent DS and cereal straw ad libitum for 28 days until reaching 3 months of age, aproximately.

Animals were slaughtered in an EU-licensed abattoir following standard protocols. Within 15 minutes of dressing, they were transported and kept under refrigerated conditions to the facilities of the Pastores Group. At 18 h post-slaughter (cold carcass weight: 11-13 kg), carcasses were split following commercial cuts. The left side of each carcass (without neck, shoulder

and leg), was obtained and refrigerated (2-4 ºC) for 30 h more (48 h of total ageing before display). Then, the commercial cuts were transported to the laboratory of the Veterinary Faculty, where *Longissimus dorsi* muscle was dissected and sliced as method sample requirements (see Figure 1). Samples were packaged individually in trays in modified atmosphere conditions, and kept at refrigeration temperature (2-4 ºC) and darkness until completing 0 (dissection day), 4, 7, or 10 days of display, when colour was measured following CIE L*a*b* methodology [4]. When corresponding display was completed, oxidation samples were frozen individually after vacuum packaging, and kept at -20 ºC until analysis (less than 1 month). TBARS (Thiobarbituric acid reactive substances) [5] were measured after 24 h of thawing in a refrigerator (0-4º C). pH was obtained previously to oxidation analysis.

To assess the statistical significance of dietary supplementation (DS) and display (D) on the instrumental quality of lamb meat, a General Linear Model (GLM) was performed. In the model, DS was treated as a fixed effect and within each DS, D was treated as a fixed effect. Descriptive statistics were calculated for each variable. To detect significant differences among means, the Duncan's Multiple Range Test was used (level for statistical significance: $p \leq 0.05$). The analyses were performed using SPSS 14.0 (2007) for Windows XP.

III. RESULTS AND DISCUSSION

Diet supplementation (DS) had no significant effect on lightness (L*) (Table 1). Throughout display, L* followed a similar significantly trend regardless DS. From 0 to 4 d of display a L* increase was shown, rather stable from 4 to 7 d of display, and another L* increase from 7 to 10 d of display.

Diet supplementation had a significant effect on redness (a*) only at 4 d of display (Table 2), where control and 100 ppm vitamin E treatments showed the highest a* values, maybe due to a higher initial value (0 d of display). D effect had higher significance than DS. 300 ppm vitamin E had a rather stable redness throughout display, since there were no statistical differences between 4 and 10 d of display. Flavonoid treatment showed a similar trend between 0 and 4 d of display but with a significant decrease between 7 and 10 d of display, showing less colour stability [6] due to the lower dose employed. Antioxidants used in this trial supposed a benefit on a* since control treatment showed significant differences throughout all the D times considered.

Diet supplementation only had a significant effect on yellowness (b*) after 4 d of display (Table 3), where higher vitamin E dose treatments (200 and 300 ppm) showed statistical differences from the lowest one (100 ppm), with the highest and the lowest b* values, respectively. Since there were no differences among control and 150 ppm EVENCIT®, antioxidants used in this trial did no suppose a benefit on b*. Display (D) had a significant effect on b*, showing the similar trend among treatments: a significant increase from 0 to 7 d of display and a significant decrease from 7 to 10 d of display, where final b* values were similar to 4 d of display ones for higher vitamin E treatments (200 and 300 ppm), showing better b* stability.

pH values (Table 4) where among 5.64 and 5.76 along display period, which can be considered normal values in lamb meat. DS had a significant effect on pH at 4 and 10 d of display. At 4 d of display, control, 100 ppm vitamin E, and 100 + 100 ppm vitamin E /EVENCIT® diets showed the lowest values, with a significant difference among the two first and the other D. At 10 d of display, 100 ppm vitamin E kept the lowest values; however, control batch showed the highest pH value. Display (D) had a significant effect on pH values for all the diet supplementations, with exception of 300 ppm vitamin E (Table 4). For every DS, pH was rather stable throughout D, although a general increase was shown from 7 d to 10 d of display, probably due to protein degradation and microbial growth.

Diet supplementation and display time had a significant effect on the level of oxidation (Table 5), the variable most affected by both effects in our study. At 0 d of display, the differences among treatments were minimal. However, at 4 d of display, control diet and 100 ppm vitamin E presented higher oxidation values, which could be related with a minimal compound dose necessary to be reflected in an antioxidant effect. In fact, 150 ppm EVENCIT® or 200 or 300 ppm vitamin E treatments showed lower values at any time (and also when vitamin E dose was increased, although without significant differences). After 7 d in modified atmosphere packaging, oxidation value did not reach the threshold for the detection of off-flavour (0.5 mg malonaldehyde/kg meat) [7] in higher vitamin E treatments, which should result in higher antioxidant effect than the flavonoids dose tested. Despite initial flavonoid treatment oxidation value was higher than in the other treatments, at 4 d of display there were no statistical differences among this and higher vitamin E doses, showing the EVENCIT® lipid antioxidant efficiency at this time (4 d after thawing), which could be considered as the limit time for consumption of thawed meat by consumers.

For all the treatments, a significant increase in oxidation value throughout display was shown (Table

5), with a similar development among them, and specially marked between 7 and 10 d of display.

IV. CONCLUSION

In general, display had more relevance on instrumental quality than the diet supplementations tested. pH and colour were little or no affected by diet supplementation, being rather stable throughout display. Vitamin E had a clear effect on oxidation, where 200 ppm could be considered a minimal efficient dose. Flavonoid supplementation (150 ppm EVENCIT®) had higher antioxidant effect than 100 ppm vitamin E and similar as the effect of higher vitamin E doses.

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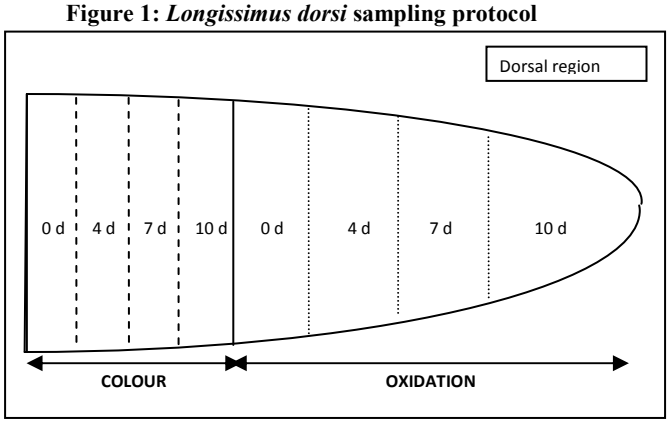
Figure 1: *Longissimus dorsi* sampling protocol



d: day

Table 1: Effect of dietary supplementation and day on L* value of lamb meat: mean and standard error deviation, signification value.

Effect	*Display day*					
Diet Sup.	0	4	7	10	SED	Sig.
100 ppm vitamin E	$38,4^{x}$	$39,9^{xy}$	$39,9^{xy}$	$41,9^{y}$	1,5	*
200 ppm vitamin E	$38,0^{x}$	$40,2^{xy}$	$40,2^{xy}$	$42,2^{y}$	1,5	**
300 ppm vitamin E	$38,2^{x}$	$40,7^{yz}$	$39,6^{xy}$	$42,1^{z}$	1,5	**
150 ppm EVENCIT®	$39,4^{x}$	$40,8^{xy}$	$39,2^{x}$	$41,4^{y}$	1,1	*
Control	$37,0^{x}$	$38,6^{y}$	$39,2^{y}$	$41,9^{z}$	1,1	**
SED	1,55	1,19	1,25	1,20	-	-
Sig.	Ns	ns	ns	ns	-	-

Sig.: Signification; SED: Standard error deviation; Sup.: supplementation; ns: no significant, * $p \leq 0.05$, ** $p \leq 0.01$; x, y, z: different letters in the same row indicate significant differences ($p \leq 0.05$)

Table 2: Effect of dietary supplementation and day on a* value of lamb meat: mean and standard error deviation, signification value.

Effect	*Display day*					
Diet Sup.	0	4	7	10	SED	Sig.
100 ppm vit. E	$11,0^{abx}$	$15,0^{bz}$	$12,9^{y}$	$12,2^{xy}$	0,9	***
200 ppm vit. E	$10,5^{ax}$	$13,5^{az}$	$13,0^{yz}$	$12,1^{y}$	0,8	***
300 ppm vit. E	$10,6^{ax}$	$13,8^{ay}$	$14,1^{y}$	$13,3^{y}$	0,7	***
150 ppm EVEN-CIT®	$10,5^{ax}$	$13,9^{az}$	$14,0^{z}$	$12,9^{y}$	0,7	***
Control	$11,8^{bx}$	$15,2^{bz}$	$14,1^{y}$	$12,3^{x}$	0,8	***
SED	0,73	0,76	0,80	0,80	-	-
Sig.	t	**	ns	ns	-	-

Sig.: Signification; SED: Standard error deviation; Sup.; Supplementation; vit.: vitamin; ns: no significant, t $p>0.05$, * $p\leq0.05$, *** $p\leq0.001$; x, y, z / a, b: different letters in the same row/ column indicate significant differences ($p\leq0.05$)