LIPID OXIDATIVE STABILITY OF COOKED-CHILLED PATTIES FROM LAMBS SUPPLEMENTED WITH DIETARY ROSEMARY DITERPENES or α-TOCOPHEROL.

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Abstract – Cooked meat products are extremely prone to oxidation during preparation and catering operations, which may adversely affect their quality traits. The objective was to compare the antioxidant effects of two lamb diets (supplemented with rosemary diterpenes or vitamin E) to delay lipid oxidation (measured as PV, TBARS and COPs) in cooked-chilled patties. Dietary vitamin E had a higher antioxidant effect than dietary rosemary diterpenes, although the level of PUFAs was higher in the meat from rosemary-fed lambs, suggesting that carnosic acid and carnosol might have inhibited fatty acid biohydrogenation in the rumen. This finding revealed the interest of combining tocopherols and diterpenes in new dietary supplements for lambs to take advantage of their different properties and their potential synergism.

Key Words – carnosic acid, carnosol, vitamin E, sheep meat oxidation.

I. INTRODUCTION

Cooked meat products are extremely prone to oxidation during preparation and catering operations, which may adversely affect their quality traits. Among the different choices available for stabilizing cooked meat in the face of oxidation, the dietary supplementation of animal feed with antioxidants is increasingly regarded as a natural alternative to using preservatives in meat products. Rosemary (*Rosmarinus officinalis L.*) is an aromatic plant that contains high levels of phenolic compounds with antioxidant potentials for the meat. While different rosemary-based diets have been tested in sheep to delay oxidation in cooked-chilled lamb [1-2], the varying degrees of success attained suggest that the oxidising status of lamb meat as a result of mincing, heating and retailing might exceed the antioxidant potential of these diets. To throw light on this question, two experimental diets containing the same levels of rosemary diterpenes or vitamin E (the natural lipid antioxidant in meat) were tested in weaned lambs. The objective was to compare the antioxidant effects of these diets on lipid oxidation in cooked-chilled lamb patties kept in catering conditions. The study is completed with nutritional data (fatty acid profile, peroxide values and cholesterol oxides) that have not been included in previous studies[1,2].

II. MATERIAL AND METHODS

Twenty-four weaned lambs (13±1 kg) were randomly assigned to one of three dietary treatments (8 lambs per treatment): a basal diet supplemented with 0.5 mg kg^{-1} feed of a dietary rosemary extract containing carnosic acid and carnosol in a 1:1 ratio (R); the basal diet supplemented with 0.5 mg kg^{-1} α-tocopheryl acetate (E); or the non-supplemented basal diet (C). All the animals were fed *ad libitum* until they reached a live weight of 24±1 kg (50 ± 8 days of fattening period). With the meat obtained, 25g-patties made from the shoulder were cooked in a double-sided griddle until a core temperature of 75 °C was reached. After cooking, the patties were packaged in a transparent polystyrene tray, covered with an oxygen-permeable polypropylene film and stored at 4˚C and 85 - 90% R.H. for 2 days with 12 h cycles of white fluorescent light (800 lx)/darkness, simulating catering display conditions. A random repeated measures model was designed in order to investigate the effect of the diet (R, E and C) and storage time (0 and 2 days) on lipid oxidation (TBARS, PV), the fatty acids content (PUFA, C18:2, C18:3n3) and cholesterol oxidation (total COPs).

III. RESULTS AND DISCUSSION

Cooked lamb patties suffered strong lipid oxidation during storage (Table 1). Diet E and R provided protection ($P<0.001$) against primary (PV) and secondary (TBARS) oxidation in the cooked lamb meat after

2 days. The oxidation trend was associated with a decrease ($P<0.05$) in the total content of PUFAs from day 0 to 2, suggesting that dietary antioxidants may have inhibited free radicals formation from PUFAs in the initial stages of the lipid oxidation chain reactions that occur in meat. From a nutritional point of view, the R-diet resulted in a meat with higher levels of C18:2n6 and C18:3n3 acids. Finally, the total content of COPs only decreased in samples from the E-diet after 2 days of storage.

Table 1. Effects of dietary supplementation of weaned lambs (rosemary diterpenes *vs.* vitamin E) on different parameters related with lipid oxidation in cooked lamb patties kept at 4ºC and aerobiosis for 0 and 2 days.

		Storage time (days)							
	Diet	0		2		SEM	P diet	P time	P dxt
TBARS	C	0.38	a y	3.09	b z	0.09	***	***	***
mg/kg meat	E	0.19	a x	1.70	b x				
	R	0.28	a xy	2.68	b y				
Peroxide Value	C	0.36	a	1.11	b y	0.08	**	***	N.S.
(mEq O_2 kg^{-1} meat)	E	0.26	a	0.58	b x				
	R	0.25	a	0.76	b x				
Total COPs	C	31.9	a	177	b y	0.92	*	***	*
mg/kg IMF	E	25.9	a	110	b x				
	R	28.1	a	159	b y				
C18:2 n6	C	5.05	x	4.66	x	0.24	*	N.S.	N.S.
(g 100 g^{-1} FAME)	E	5.21	x	5.02	x y				
	R	5.49	y	5.24	y				
C18:3 n3	C	0.26		0.24	x	0.02	*	N.S.	N.S.
(g 100 g^{-1} FAME)	E	0.24		0.24	x				
	R	0.27		0.30	y				
ÓPUFA	C	7.51	b	6.70	ax	0.30	*	***	*
(g 100 g^{-1} FAME)	E	7.38	b	7.11	ay				
	R	7.72	b	7.38	ay				

Lamb diets: C (control); E (supplemented with α-tocopherol); R (supplemented with rosemary extract).
SEM = Standard Error of the Mean; TBARS: Thiobarbituric Acid Reagent Substances; Total COPS: total Cholesterol Oxidation Products; PUFA: Polyunsaturated Fatty Acids; FAME: Fatty Acid Methyl Ester.
[a,b,c] storage time effects ($P\leq0.05$); [x,y,z] diet effects ($P\leq0.05$); P: Probability values. ***($P\leq0.001$); **($P\leq0.01$); *($P\leq0.05$); N.S ($P>0.05$).

IV. CONCLUSION

Dietary vitamin E had a higher antioxidant effect on cooked-chilled lamb than dietary rosemary diterpenes, but the level of PUFAs was higher in the meat from rosemary-fed lambs, suggesting that the intake of carnosic acid and carnosol inhibited fatty acid biohydrogenation in the rumen, as has been previously reported.[3] This findings point to the interest of combining tocopherols and diterpenes in new dietary supplements for lambs to take advantage of their different properties and their potential synergism.

V. REFERENCES

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