ANTIOXIDANT SUPPLEMENTATION IS INEFFECTIVE TO REDUCE THE FREQUENCY OF PSE-LIKE ZONES IN PORK HAMS

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I. INTRODUCTION

The frequency of pork hams with PSE-like zones is a major issue for the processed meat sector in France, despite recent improvements in the slaughter techniques and systematic sorting on the ultimate pH value of hams. Halothane genotype, still widespread in its heterozygous form, may play a significant role in this issue [1]. On the other hand, a recent work described at a molecular level a possible link between oxidative stress and the specific development of PSE-like zone [2]. From this hypothesis, an experimental design was carried out at the IFIP Experimental Station to evaluate the effect of antioxidant supplementation in pig diet on the appearance of PSE-like zone and more generally on the overall ham quality before and after cooking process.

II. MATERIALS AND METHODS

A batch of 204 pigs, from Piétrain sires which are homozygous for the halothane mutation nn, where fattened at the IFIP Experimental Station. The animals were fed with either a basal diet (Control group) or a basal diet supplemented with vitamin E (300 mg/kg), vitamin C (300 mg/kg) and organic selenium (0.2 mg/kg) during the nine last weeks of fattening (Antioxidant group). The two groups were slaughtered simultaneously after a 24h fasting. The pH1 (30 min. *post mortem (pm)*) and ultimate pH (pH24 ext., at 24h *pm*) were measured at the external side of the *Semimembranosus*. Prior to deboning, the meat color was measured at 24h *pm* on the *Gluteus Medius* with a CR-400 colorimeter (Konica Minolta, Japan). After deboning, structural defects were evaluated on hams according to the PSE-like zone IFIP scale [3], then drip loss sampling (EZ method) was carried out on the internal side of the *Semimembranosus*. The drip loss was measured after 48h of storage at 6°C. Ultimate pH was also measured at the internal side of the *Semimembranosus* (pH24 int.). Cooking yield was measured following industrial "jambon cuit supérieur" process without individual traceability. Two batches of 98 hams were processed (Control group *vs* Antioxidant group) and sliced. The "paste-like" slice defect frequency was evaluated on the final product [1]. The effect of antioxidant was performed on meat quality traits (pH1, pH24 int., pH24 ext., L*a*b*) and on process traits (cooking yield, slicing defect rate) using the GLM procedure (SAS Institute, USA). The FREQ procedure was applied on PSE-like zone class data.

III. RESULTS AND DISCUSSION

We observed 5% of PSE meat (pH1<6.0) which is higher than the frequency generally observed (1.5% in a survey in 15 slaughterhouses in France [4]). The pH24 (ext.) is also lower than the average value observed on 1.6 million carcasses in 2015 (pH24=5.71 [5]). Considering these meat quality traits and the fact that all pigs were heterozygous for halothane genotype (Nn), it was not surprising to observe a total of 46% of hams showing severe PSE-like zone defects (class 3+4).

Table 1: Meat quality of the whole data set (n=204) and by PSE-like zone class – *Semimembranosus* muscle

	n=	m (sd)	PSE-like zone class[1]				p
			1	2	3	4	
pH1 *(ext.)*	203	6.27 (0.20)	6.34	6.26	6.28	6.17	0.02
pH24 *(ext.)*	194	5.64 (0.10)	5.74	5.66	5.60	5.56	<0.0001
pH24 *(int.)*	194	5.70 (0.17)	5.93	5.73	5.61	5.59	<0.0001
L* *(int.)*	193	58.8 (5.0)	52.3	56.8	62.0	64.3	<0.0001
Drip loss (%)	195	5.9 (2.0)	3.69	5.68	6.36	7.81	<0.0001

1: class 1=no defect; class 2=slight defect; class 3= deep defect on Semimembranosus; class 4= deep defect on several muscles (incl. SM)

PSE-like zones showed typical meat quality changes in comparison with meat free of defect: L* increase, and pH1, pH24, drip loss decrease (table 1). The dietary treatment did not affect pH24, L* and drip loss, in agreement with Monziols *et al.* [6] study focusing on vitamin E and selenium supplementation. However, pH1 differed significantly with a lower value in the Antioxidant group, for which no explanation was found. Our results were not in agreement with the study of Mourot *et al.* [7] who reported higher pH and lower drip loss with vitamin C supplementation.

Table 2: effect of antioxidant supplementation on meat quality of the *Semimembranosus* muscle

	Control	Antioxidant	p
pH1 *(ext.)*	6.30	6.23	0.01
pH24 *(ext.)*	5.65	5.62	0.06
pH24 *(int.)*	5.70	5.71	ns
L* *(int.)*	58.8	59.0	ns
Drip loss (%)	5.67	6.17	0.09

The antioxidant supplementation did not reduce the PSE-like zone frequency, therefore not confirming our hypothesis on a possible effect of antioxidant on the defect appearance. Despite a lower pH1 in Antioxidant group, a higher cooking yield was reported suggesting a protective effect of the diet on proteins (table 3). However, as reported on raw meat, the “paste-like” slice frequency was unchanged.

Table 3: effect of antioxidant supplementation on the frequency of PSE-like zones and processing yields

Frequency of PSE-like zone class (%)	Control	Antioxidant	p
1	15.8	12.1	ns
2	43.1	37.4	
3	33.7	33.3	
4	7.4	17.2	
Cooking yield (%)	84.7	85.4	0.05
“Paste-like” slice frequency (%)	40.2	35.9	ns

IV. CONCLUSION

In this study, the supplementation of antioxidant in the pig diet (vitamin E, vitamin C and organic selenium) did not reduce the frequency of PSE-like zone. However, the frequency of PSE-like zone was particularly high in this study (46%). It has been shown an additive effect of low pH24, low pH1 and halothane mutation status, being considered as major risk factors for PSE-like development.

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