

Redox Potential and pH in Beef Psoas Major During Long Term Refrigerated Storage

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Introduction

Oxidation is linked to deleterious effects on meat characteristics, primarily flavour and colour. Promotion and prevention of colour defects in meat was related to reducing or oxidizing conditions by Cornforth et al. (1986). Then the antioxidant status of tissue would be important to protect tissue quality during storage and processing. It has been reported that the efficacy of antioxidants as an inactivator or inhibitor of oxygen radicals will be influenced by energetics (redox potentials) among other properties (Simic and Jovanovic, 1994), that the dietary modulation of cellular redox state may be one mechanism behind the association between certain pathologies and diet (Djuric et al., 1992) and that the redox potential (Eh) was the variable that most influenced the appearance of colour defects in cooked turkey meat (Cornforth et al., 1986). Thus knowledge on tissue redox potential would be useful to predict the shelf-life of the products. The research objectives were to measure Eh, pH and beef subjective colour during vacuum packaged refrigerated storage of beef *Psoas major* muscle.

Material and Methods

Twelve Psoas major from 6 British crossbreed steers were used. Slaughter and deboning was performed in a local abattoir following GMP. The muscle were bring into the lab 48 hs after deboning and scheme showed in Figure 1 was followed. In Figure 1A it is indicated the procedure followed for 5 of the replicates. The Figure 1B the procedure for this replicates 6, where the right and left Psoas were analysed at the same time to overrule any differences between right and left muscle. The bags with the meat portions were opened and pH and Eh were measured under nitrogen. Eh were determined in the tissue (1.5 ± 0.5 cm in depth) and in meat slurries (10% v/w), using a Metrohm pH meter model 691 equipped with a combination electrode consisting of a platinum redox and a silver/silver chloride reference electrode (Metrohm AG 9101). Samples from the surface and centre of other Psoas meat portions that have received the same process were analysed for vitamin E content. The determinations were performed on an hexane extract of the saponified homogenate by HPLC using electrochemical detection (Pfalzgraf, et al., 1995). Subjective colour was evaluated using a quality scale from 0 to 5 (0= unacceptable, major defects, 5= excellent, no defect)

Result and Discussion

Eh measured in tissue and tissue slurries are shown in Table 1. Meat portions Eh from left and right Psoas major were not significantly different. Five of the samples followed the same pattern, however Eh values of sample 6 were significantly different from the rest. The meat portions from this sample were the only ones that had a 5 point score in colour evaluation along the storage period (Figure 2A). The pH curve for this sample and the average of the rest of the replicates is presented in Figure 2B. Despite the greater difference in absolute values between the centre and surface of the scored 2 samples, there was no significant difference between the vit E content (Table 2). The dispersion of the data could indicate the necessity of a larger assay to settle this point.

Conclusion

From 6 replicates only one and its duplicate (right and left Psoas from one steer) showed a different Eh pattern. These samples also had different pH curve and colour evaluation scores. This study shows in agreement with the results of Cornforth et al. (1986) the necessity of maintaining certain Eh conditions to prevent colour defects in commercial processes. Thus redox potential could be a useful tool, besides vit E, in the study of tissue antioxidant status.

References

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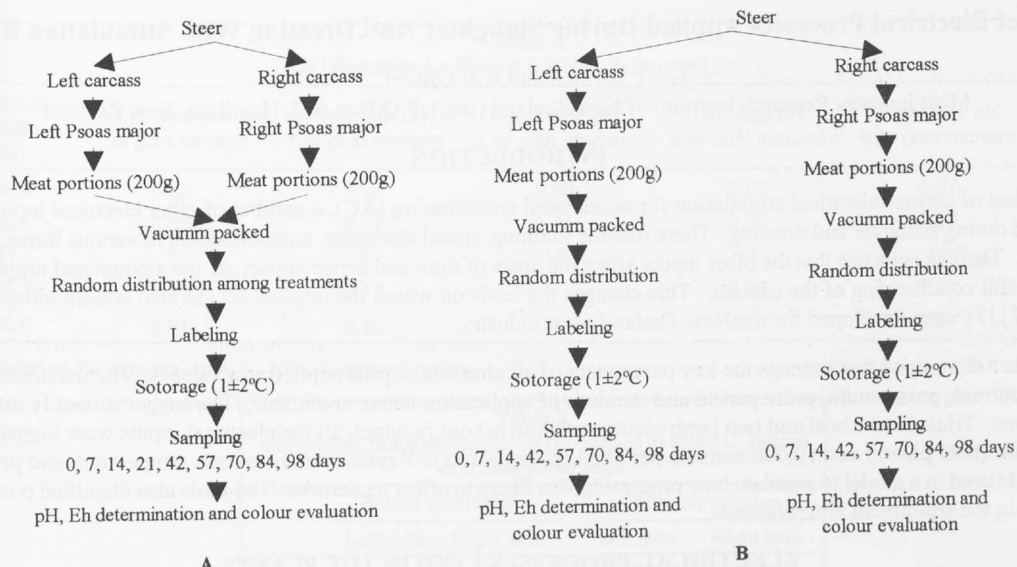


Figure 1 : Sampling procedure

Table 1 : Eh from tissue and Tissue Slurries of *Psoas major*

Replicate	Day 0		Day 7		Day 14		Day 21		Day 42		Day 57		Day 70		Day 84		Day 98	
	Eh (mV)																	
	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T
1	-12	-36	-56	-49	-44	-64	-97	-63	-21	-77	-33	-76	-64	-101	-46	-159	-44	-74
2	-30	-47	-27	-34	-29	-287	-151	-64	-81	-101	-47	-82	-12	-89	-24	-56	-42	-67
3	-36	-60	-62	-60	5	-47	-68	-121	-25	-92	-66	-113	-13	-93	-78	-151	-54	-86
4	-28	-54	-33	-81	-126	-40	-187	-119	-40	-84	-23	-75	-14	-95	-58	-75	-12	-90
5	-86	-78	-76	-95	-52	-40	-148	-94	-54	-69	-39	-80	-16	-80	-11	-103	-10	-78
6	-69	-115	-217	-130	-260	-72			-291	-329	-176	-211	-176	-227	-175	-227	-164	-187

S : Eh from tissue slurries ; T : Eh from tissue

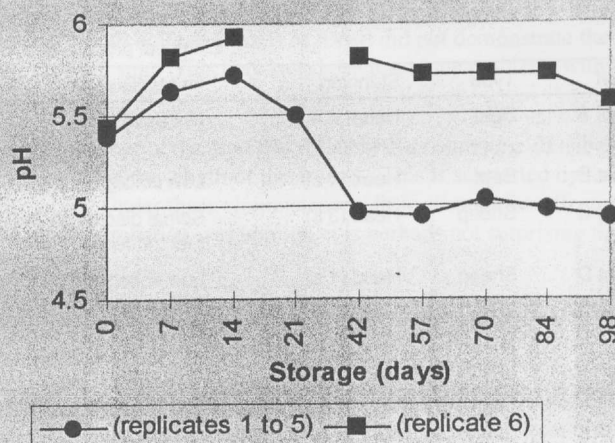
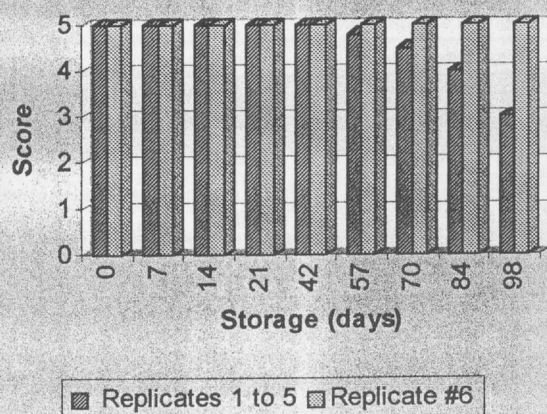


Figure 2A : Subjective colour evaluation in meat portions and pH determination in tissue slurries

Table 2: Vitamin E (a-tocopherol) content in *Psoas major* (mg/g tissue)

Sample	Storage (1±2°C)	Surface	Center
Fresh Psoas	48 hs	9.80±0.60a	10.10±0.20a
Scored 2	90 days	8.13±3.03b	10.56±1.70b
Scored 5	90 days	7.40±0.45c	7.43±1.70c

Files bearing the same letters shown no significant difference ($p>0.05$)