LOW VOLTAGE ELECTRICAL STIMULATION: EFFECTS ON BEEF QUALITY

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INTRODUCTION

A great deal of work has been conducted on the effects of electrical stimulation (ES) on meat quality. ES accelerates glycolysis, depletion of ATP, pH fall and instalation of rigor mortis, Demeyer et al. (1980). Throughthe use of ES, meat becomes more tender mainly because avoids cold shortening. This phenomenon that makes meat tougher occurs when the temperature of the carcasses has fallen bellow 11 C before the pH has fallen bellow 6.2, Bendall (1972). Work conducted by Bouton et al. (1980) demonstrates that in non stimulated carcasses pH 6.0 is reached in 8 h whilst with ES at 110 V (peak) it takes only 2 h after stunning to reach the same pH.

OBJECTIVE

To check the effectiveness of low voltage ES on beef quality.

MATERIAL AND METHODS

The work was conducted in a Packing Plant that had already the apparatus installed. Thirty-six Polled Hereford steers with an average of 2 years of age were used. Half of them were ES (21 V and .25 Amps) applied about 3 minutes after bleeding with a nasal electrode for 18 seconds, using a Jarvis tool, model BV 80 with automatic turn-off. The average live weight of the steers was 436 kg.

The carcasses were chilled for 24 h in a chill room with average temperature of 0°C, humidityof 90% and air velocity of around 2 m/s. The drop in temperature and pH was measured at 2, 4, 6, 8, 10, 12 and 24 h port-mortem directly in the loin between the 10 and 11 rib. After 24 h chill, samples from the loin were removed and transported to the meat laboratory for sensory evaluations. The steaks were roasted to an internal temperature of 70°C.

RESULTS AND DISCUSSION

Table 1, shows some data obtained from the carcasses.

TABLE 1. CARCASS PARAMETERS OF STIMULATED AND NON STIMULATED STEERS CARCASSES

		ES n = 18	NS n = 18	Probab.
Warm carcass weight	kg	241.19	236.42	.18
Conformation		Good	Good	.54
Physiological maturity		A	A	.29
Fat thickness	mm	7.19	5.89	.17
Marbling		Small	Small	.47

ES = Electrictrically stimulated NS = Non stimulated

As can be seen both groups were quite similar in carcass characteristics. Table 2, displays the drop in temperature in the groups.

TABLE 2. TEMPERATURE DECLINE IN STIMULATED AND NON STIMULATED STEER CARCASSES

Time after bleeding h	ES n = 18	NS n = 18	Probab.
2	22.04	21.51	.57
4	19.17	16.98	.01
6	15.42	13.46	.01
8	12.93	11.52	.01
10	10.87	9.01	.01
12	8.51	6.52	.01
24	.23	-.74	.01

ES = Electrically Stimulated NS = Non stimulated

The ES carcasses cooled slower, although in both groups the drop in temperature was very fast. It is well known that carcass weight and finish can affect temperature decline, Koomaraie et al. (1988b) and Fisher et al. (1992). It was not the case in this work. The explanation may be found in the low temperature in the chill room (0°C), air velocity too high (around 2m/s) and area: just 36 carcasses in a space for 100.

Table 3, reports the pH decline in the two groups.

TABLE 3. pH DECLINE IN STIMULATED AND NON STIMULATED STEERS CARCASSES

Time after bleeding h	ES n = 18	NS n = 18	Probab.
2	6.40	6.42	.77
4	6.28	6.26	.75
6	6.07	6.00	.21
8	5.90	5.86	.38
10	5.87	5.79	.18
12	5.62	5.59	.62
24	5.52	5.54	.63

ES = Electrically stimulated NS = Non stimulated

There was no significant difference in the pH fall between the two groups what disagrees with the results reported in the litterature, Demeyer et al. (1980) and Bouton et al. (1980). pH 6.0 was obtained in about 6 h instead of 2 as reported by previous researchers.

Table 4, shows sensory evaluation.

TABLE 4. SENSORY EVALUATION OF STIMULATED AND NON STIMULATED STEERS CARCASSES

		ES n = 18	NS n = 18	Probab.
Cooking loss	%	32.50	30.55	.03
Panel tenderness *		5.94	5.70	.55
Panel juiciness *		5.83	5.66	.46
Panel flavor *		6.06	5.84	.26
Shear force	kg	9.52	9.75	.73
Sarcomere length		1.72	1.74	.46

ES = Electrically stimulated NS = Non stimulated
* 5 = average 9 = very tender, juicy, flavorful

The only significant difference noticed was in cooking losses. ES presented a higher cooking loss what agrees with the litterature. Tenderness values when measured by shear force, showed tougher steaks for this age, weight and finish. Müller (1991) reported values of 6.5 kg for this kind of steers what is the normal value encountered for european breeds in Brasil. What occured looking at the fall in temperature and pH is that ES was applied for a too short period of time and that both groups had problems with cold shortening.

According to Bendall (1972), cold shortening sets in when the carcasses reach pH 6.2 at 11 C or less. Rhodes (1972) stated that meat becomes tougher everytime the carcasses present a temperature of 10°C or lower in 10 h, what happened in this work.

Observing the sarcomere length with an average of 1,73 in a range of 1.5 to 1.9 it can be concluded that many of the carcasses had shortened above normallity.

CONCLUSIONS

- The ES applied in the Packing Plant was ineffective in improving meat tenderness
- The conditions in the chilling room were not well controlled

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