MANUAL AND AUTOMATIC ELECTRICAL STUNNING OF SLAUGHTER PIGS WITH RESPECT TO SOME ASPECTS OF MEAT QUALITY

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INTRODUCTION

In Brazil the laws regulating pig slaughtering require animals to be insensible to pain, but alive when exsanguinated. The stunning should achieve instantaneous and complete unconsciousness, from the view point of animal welfare and meat quality (SILVEIRA *et al.*, 1993).

Most Brazilian pig abattoirs stun the animals by means of an electric current. There are different versions of this type of electrical stunning equipment. Manually operated tongs usually use voltages which vary from 90 to 250 V whereas fully automatic plant applies 400 to 600 V. High voltage electrical stunning combined with bleeding in a horizontal position is progressing well in Brazil specially in the abattoirs which have been increasingly mechanized and rationalized.

The objective of this study was to investigate the influence of manual and automatic electrical stunning on some meat quality characteristics (R - value, pH, blood splashing, water holding capacity - **WHC**, drip loss, boiling loss, firmness and microbiology).

MATERIAL AND METHODS

Comparative studies on electrical stunning of pigs were undertaken in a commercial abattoir in the West part of Rio Grande do Sul (Brazil).

Forty eight animals (live weight 84.4 - 86.6 kg), 24 male and 24 female, were randomly assigned to the following treatments: automated high voltage (450 V, 60 Hz, 3.0 A during 5 sec.) applied on male (**A**) and female (**B**); manual low voltage with tongs (100 V, 60 Hz, 0.4 A during 15 sec.) applied on male (**C**) and female (**D**). Carcasses from the mentioned treatments groups were split and the sides were boned after 22 h at 2°± 2°C. After boning, *M. longissimus dorsi* (**LD**) and *M. semimembranosus* (**SM**) were immediately vacuum packaged, chilled and stored during 7 days at 5°±2°C. The absorption ratio (R - value) of **LD** muscle after 1 hour *post mortem* was prepared according to the HONICKEL & FISCHER, 1977. pH was measured after sticking rigor development 1 and 24 hours for **LD** and **SM** (central portion), using a pH - meter with a combination electrode, Ingold WTW 91. 22 - 24 hours after slaughter, blood splashing was evaluated in the above two muscles plus *M. quadriceps* (**Q**) and *M. biceps femoris* (**BF**) according to BARTON - GADE *et al.* (1992). 24 hours *post mortem* **WHC** in **SM** and drip loss in **LD** were carried out following the methodology reported by SILVEIRA *et al.* (1995) while boiling loss and firmness in **LD** (SILVEIRA *et al.* 1995) as well as Psychotropic Count and *Salmonella* (VANDERZANT *et al.*, 1992) in the vacuum packed meat cuts **LD** and **SM** stored under above conditions were performed. The results were subjected to analysis of variance and treatment differences were tested with the Tukey test for significance at the 5% level.

RESULTS AND DISCUSSION

Statistical results of the major meat quality measurements (R - value, pH, blood splashing, **WHC**, drip loss, boiling loss and firmness) is shown in Table 1.

It can be seen that the electrical stunning techniques studied resulted in R - values 1 hour *post mortem* lower than 1.05. Muscles showing R - values above 1.05 have been reported to exhibit PSE condition (YANG *et al.*, 1984). In the present experiment, R - values were significantly higher ($p<0.05$) and pH_1 in both **LD** and **SM** muscles were significantly lower ($p<0.05$) indicating an enhancing on *post mortem* glycolytic rate when manual stunning is applied. pH_1 values obtained were lower than those reported by WOLTERSDORF and TROEGER (1987) and near to the critical range (**LD**, $pH_1 < 5.6$ and **SM**, $pH_1 < 5.8$) where PSE properties are likely to develop (TROEGER and WOLTERSDORF, 1990).

As was expected, poor conditions for the animal's welfare were found when stunning was applied manually. An indication of this was the negative effect on meat quality when blood splashing is taken into account as well as the significant reduction ($p<0.05$) of **WHC** reaching values lower than 0.4, considered by RING and KORTMANN (1988) as PSE meat. In addition to this manual stunning increased the drip loss, boiling loss and firmness significatively ($p<0.05$).

The results of Psychotropic bacteria counts and *Salmonella* sp are presented in Table 2. The Psychotropics population in all treatments studied was very low and no *Salmonella* sp was found.

CONCLUSION

On the basis of the present investigation, high voltage automatic electrical stunning should be encouraged and recommended as a suitable technology to stun pigs. Currently this technique is being applied in combination with bleeding in a horizontal position in most Brazilian pig abattoirs. The quality advantages confirmed in this study ensure the success of this technology and its beneficial effect to the meat industry.

Table 1. Mean values for the meat quality characteristics.

Variable	Muscle	Treatments			
		A	B	C	D
R - value	LD	0.9242^{a}	0.9286^{a}	0.9743^{b}	0.9885^{b}
pH_1	LD	5.91^{a}	5.87^{a}	5.68^{b}	5.59^{b}
pH_1	SM	5.93^{a}	5.84^{a}	5.64^{b}	5.66^{b}
Blood splashing	LD, SM, BF e Q	2.17^{a}	2.50^{ab}	2.67^{ab}	2.84^{b}
WHC, G value	SM	0.5421^{b}	0.5336^{b}	0.3988^{a}	0.3930^{a}
Drip loss, %	LD	4.40^{a}	5.94^{b}	5.66^{b}	6.58^{c}
Boiling loss, %	LD	21.17^{a}	27.66^{a}	36.51^{b}	35.62^{b}
Firmness, Kgf	LD	2.31^{a}	2.24^{a}	3.01^{c}	2.83^{b}

A = automated high voltage, male B = automated high voltage, female
C = manual low voltage, male D = manual low voltage, female
Means within a row with different superscripts are significantly different ($p<0.05$)^{a,b,c}

Table 2. Psychotropic Total Count and *Salmonella* sp in pork meat cuts

Test	LD				SM			
	A	B	C	D	A	B	C	D
Psychotropic Total Count (CFU/cm^2)	$2.3x10^2$	$1.4x10^3$	$3.7x10^1$	$4.7x10^2$	$2.1x10^2$	$3.9x10^2$	$4.2x10^3$	$1.1x10^3$
Salmonella sp (25g)	absent	absent	absent	absent	absent	absent	absent	absent

A = automated high voltage, male B = automated high voltage, female
C = manual low voltage, male D = manual low voltage, female

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