THE INFLUENCE OF STUNNING TECHNIQUES ON SOME QUALITY ASPECTS OF PIG MEAT

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INTRODUCTION

Pre–slaughter stunning should render animals insensible to pain. Welfare perspectives have also made it imperative to ensure that animals do not suffer needlessly during slaughter procedures (COOK *et al.,* 1995). Stunning methods must provide an assurance of this so that adverse effects on meat quality will be avoided.

The improvement in quality (reduction in both blood splashing and the incidence of PSE meat considerably and fractures are eliminated) more than outweighs the extra running costs of CO_2 stunning has been the reason why Denmark uses CO_2 stunning for pig slaughter (BARTON-GADE *et al.*, 1992). In Brazil high voltage electrical stunning combined with bleeding in a horizontal position is progressing well specially in the abattoirs which have been increasingly mechanized and rationalized (SILVEIRA *et al.*, 1997).

The aim of this study was to investigate the influence of pre-slaughter stunning (electrical and CO_2) on some meat quality characteristics (pH, color, blood splashing, solubility and water holding capacity – **WHC** of myofibrils proteins and microbiology).

MATERIAL AND METHODS

Comparative studies on pre-slaughter stunning of pigs were undertaken in a commercial abattoir in the West part of Santa Catarina (Brazil).

Thirty six animals (live weight 95.6 – 100.4 kg), 18 male and 18 female, were randomly assigned to the following treatments: unrestrained and unstunned control applied on male (**A**) and female (**B**); electrical (220 V, 60 Hz, 0.9 – 1.2 A during 5 sec.) applied manually on male (**C**) and female (**D**); immobilized by inhalation of a gas mixture (70% CO_2 and 30% of air during 60-75 sec.) applied on male (**E**) and female (**F**). Carcasses from the mentioned treatments groups were split and the sides were boned after 23 h at 2°± 2°C. After boning, *M. longissimus dorsi* (**LD**) was immediately vacuum packaged, chilled and stored during 7 days at 5°±2°C. pH was measured after sticking rigor development 1 and 24 hours for **LD** (central portion), using a pH - meter with a combination electrode, Ingold WTW 91. 23 - 25 hours after slaughter, color was measured by a tristimulus color analyzer Minolta CR-200b using CIE L*a*b* color space on the surface of **LD** and blood splashing was evaluated in the same muscle according to BARTON - GADE *et al.* (1992). 36 hours *post mortem* protein solubility and **WHC** were carried out following the methodology reported by SILVEIRA (1997) while *Salmonella* (VANDERZANT & SPLITSTOESSER, 1992) in the vacuum packed meat cuts **LD** stored under above conditions was 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 (pH, color, blood splashing, solubility and **WHC** of myofibrils proteins is shown in Table 1.

It is possible to observe the importance of stunning techniques, irrespectively electrical or CO_2. The omission of this operation in the slaughter procedures added an stressful factor fasting the rate of *post mortem* glycolysis. In the present experiment, pH_1 was significantly lower ($p<0.05$) for the unstunned unrestrained pigs indicating an enhancing on *post mortem* glycolytic rate. pH_1 (5.54 and 5.58) and pH_{24} (5.44 and 5.49) values obtained reached the critical range - $pH_1 <$ 5.6 (TROEGER and WOLTERSDORF, 1990) and $pH_{24} = 5.48$ (WALL *et al.*, 1995) - where PSE properties are likely to develop. This evidence was also supported through the luminosity ($L^* = 54.08$ and 54.58) results which are near to the values ($L^* = 55.5 \pm 0.6$) reported by WARNER *et al.*, (1997) as PSE meat.

It has been postulated that poor conditions for the animal's welfare may have unfavorable effects on *post mortem* metabolism and meat quality characteristics. An indication of this was observed in this study when blood splashing is taken into account as well as the significant reduction ($p<0.05$) of protein solubility and **WHC** of **LD** muscle myofibrils for the unstunned unrestrained pigs. Stunning in general, increased **WHC** values significatively and this fact can be mainly attributed to the total of myosin solubilized, since myosin is largely responsible for **WHC** in meat systems (SILVEIRA *et al.*, 1995).

No *Salmonella* sp were detected in any of the samples examined.

CONCLUSIONS

The results of this investigation support the conclusion that any stress placed upon pigs immediately before slaughter should be avoided. The relatively high glycolytic rate of unrestrained unstunned animals highlights the need for care in handling swine in the period immediately prior to slaughter.

Considering the functional properties investigated CO_2 stunning seemed most attractive. The problem is mainly to avoid frightening the pigs when driving them and thus reduce excitement before they reach the anesthetization plant whether it is operating with electricity or carbon dioxide. The quality advantages confirmed in this study ensure the success of pre-slaughter stunning and its beneficial effect to the meat industry.

Table 1. Mean values for the meat quality characteristics evaluated in *Longissimus dorsi.*

Variable	Treatments					
	A	B	C	D	E	F
pH_1	5.54^{a}	5.58^{a}	5.96^{b}	6.20^{c}	5.98^{b}	6.18^{c}
pH_{24}	5.44^{a}	5.49^{b}	5.50^{b}	5.54^{c}	5.58^{d}	5.61^{e}
L*	54.08^{c}	54.84^{c}	46.78^{b}	46.73^{a}	46.38^{ab}	46.68^{ab}
a*	5.65^{bc}	5.80^{c}	5.40^{a}	5.43^{ab}	5.60^{abc}	5.42^{ab}
b*	14.75^{d}	14.32^{d}	6.65^{a}	6.73^{ab}	6.98^{c}	6.95^{bc}
Blood splashing	1.92^{a}	1.96^{a}	1.08^{b}	1.12^{b}	1.17^{b}	1.12^{b}
Protein solubility (%)	25.00^{b}	24.00^{a}	28.50^{c}	28.25^{c}	32.00^{d}	32.25^{d}
WHC (%)	22.50^{a}	22.00^{a}	32.25^{b}	31.75^{b}	37.00^{c}	36.50^{c}

A = control, male B = control, female C = electrical, male D = electrical, female
E = CO_2, male F = CO_2, female
Means with different superscripts on the same line are significantly different ($p<0.05$)^{a,b,c,d,e}

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