COMPARISON OF TWO PROCEDURES FOR PIG MOVING ON PRESLAUGHTER HANDLING AND THEIR STRESS EFFECT ON MEAT QUALITY

Ludtke, C.B[*].; Silveira, E.T.F[**].; Silveira, N.F.A**.; Bertoloni, W[***].; Andrade, J.C. de[**]; Bessa, L.R.[***]; Soares, G.J.D[****]

**Universidade Estadual Paulista / UNESP / FCA / Botucatu- e-mail: charli@fmvz.unesp.br;*
[**] *Instituto de Tecnologia de Alimentos / ITAL / Campinas- e-mail: tadeu.s@uol.com.br; nfa@ital.sp.gov.br*
[***] *Universidade de Campinas / FEA / Campinas- e-mail: bt.william@ig.com.br;*
*****Universidade Federal de Pelotas / FAEM / DCTA- e-mail: germojds@ufpel.tche.br*

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Introduction

There are many factors contributing to increase animal stress during the pre-slaughter handling, which could modify drastically their meat quality, particularly in pork. One of those is an inadequate animal moving or conduction using electric prods that may result in abnormal undesirable muscle conditions. A lack of regulations associated with the easy manipulation of this particular instrument is inducing their intensive use into abattoirs plants in detriment of animal welfare. The electric prods can cause an increasing of physiological response that modifies the pig behavior (Brundige *et al.* 1998) with consequences in meat quality. High level of pre-slaughter stress causes an increase of glycolitic rate, interference in muscle glycogen reserve and pH dropped, which combined to the body temperature near physiological state reduce water retention. The substitution of electric prod by board for pig moving could be an efficient system for solving handling problems and improving pork quality.

Objectives

The aim of the present experiment was to compare the effect of two types of pig moving (conduction) at pre-slaughter handling in relation to the levels of stress and on meat quality.

Methodology

Animal. A total of 120 pigs with similar age, sex and genotype were used. All animals came from the same farm, 250km away from the slaughter plant. The pigs were divided in two groups (n=60) to submit to loading-unloading for settling in abattoir using two apparatus for moving: G1 (board) and G2 (electric prod). The total fasting period (farm, transport and lairage) was 18 hours.

Stress evaluation. During exsanguinations plasma samples (n=120) were collected and frozen in liquid nitrogen for analysis of physiological indicators of animal stress. The total plasma cortisol concentration was quantified by means of RIA (Coat-A-Count Cortisol Kit, Diagnostic Products Corporation-DPC, Los Angeles, USA) and lactato levels by spectrometric methods (Lactat PAP enzyme. Farbtest, Rolf Greiner Biochemica, Flacht, Germany).

Meat quality evaluation. Meat quality characteristics were evaluated in 35 pigs from each treatment. The carcass pH was carried out at 4, 6, 8 and 24 hours of *post mortem* in *Semimembranosus* (SM) muscle using a pH meter (INGOLD-WTW). The color by CIE L*, a*, and b* values were determined with a Minolta chroma colorimeter (Mod. CR300) and a muscle light reflectance by Hennessy probe (HGP). The water holding capacity was determined following the methodology described by (Hoffmann *et al*., 1982) and drip loss was evaluated according to the Honikel (1988) method.

Molecular analysis for gene *hal* characterization. A total of 24 pigs from each treatment were used to determine the gene hal. The Genomic DNA was extracted from muscular fiber using equipment Ryboliser that causes cellular damage by friction with the glass pearls releasing genetic material (Ludtke *et al*., 2001). After DNA purifying it was submitted to PCR reactions using specific *primers* for amplifying DNA fragments with 81 base pairs of *hal* gene (Fujii *et al*, 1991). The resulting PCR reactions were digested by a restriction endonuclease enzyme *Cfol* (GIBCO-BRL) followed by agarose gel electrophoresis in accordance with Sambrook *et al*. (1989) and modifying introduced by Bastos (1998).

Statistic analysis. The data for meat quality and physiological parameters of stress were analyzed by least squares analysis of variance and correlation using the general linear model (GLM) and CORR (Pearson) with the Statistical Analysis System (SAS, version 6.12).

Results & Discussion

There were significant differences (P<0.05) between G1 and G2 groups (Table 1) for the muscular pH results at 4, 6, and 8 hours *post mortem*. G2 group presented lower pH values in relation to G1. This pH decline suggest that a higher glycolitic rate in the muscle had happened which was also reported by Fernandez & Tornenberg (1991). The coercion for moving pigs induces stress and consequentially PSE meat is a potential risk.

It was verified that the color and light reflectance values had no significant differences (P>0,05) between G1 and G2. Similar results in color and postmortem pH were observed by Van der Wal *et al.* (1999) and D´Souza *et al.* (1998). The treatment studied had also no significant differences (P>0.05) in relation to the water holding capacity (WHC) (Table 1).

Applying what was proposed by Warner *et al.* (1997) for average values of color, exudation loss and pH on treatments (G1 and G2) those sample meats could be classified as reddish, soft and exsudative (RSE) or red, firm and normal (RFN). So, it was observed significant difference (P<0.05) in the incidence of PSE percentage between G1 (13.64%) and G2 (23.53%), while had no difference for meat classified as RSE. An electric prod removing in processing plants reduced PSE (80 to 33%) and by controlling current on insensitivity equipment (Faucitano *et al.* 1998).

The PSE or RSE condition has no association with the *hal* gene because the genotype frequencies among fiber samples confirm a lack of recessive homozygote (nn=0%) and low frequency of heterozygote (Nn=14.3%). There were significant differences ($p<0{,}001$) for cortisol and lactate values (Table 2) between G1 and G2 groups. The electric prod raised cortisol and lactate concentrations which could be associated with physic and psychological stress in animals. Brown *et al.* (1998) and Warriss *et al.* (1994) have reported similar values for swine slaughtered in high stress system ($17.02\mu g.100mL^{-1}$ and $139.8\ mg.100mL^{-1}$) and lower stress ($7.62\mu g.100mL^{-1}$ and $63.5mg.100mL^{-1}$).

Conclusions

The quality traits results found in this experiment were not affected ($p>0.05$) by treatments studied.

There is a need to handle pigs faster in abattoirs and this prone may not be matched by improvements in handling facilities and practices. The replacement of electric prods by boards in pre-slaughter handling improved animal stress and meat quality in the conditions applied in the present experiment work.

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Table 1. Quality characteristics evaluated in *Longissimus dorsi* (LD); *Semimembranosus* (SM) pig muscles according to the pre-slaughter handling.

Quality characteristics	pre-slaughter handling [a]		Significance
	Lower stress G1	Higher stress G2	
pH (4 h)–SM	6,58 0,22^{b}	6,36 0,3^{c}	0,0008 ***
pH (6h) –SM	6,39 0,18^{d}	6,10 0,26^{e}	0,0001***
pH (8h)–SM	6,08 0,19^{f}	5,83 0,21^{g}	0,0001***
pH (24h)–SM	5,54 0,14^{a}	5,60 0,14^{a}	0,206
Color L* – LD	48,62 1,90	49,70 4,7	0,209
Color a* – LD	0,41 0,43	0,69 1,01	0,384
Color b*– LD	7,12 0,60	7,32 1,38	0,989
Internal Reflectance (45min.) – LD	30,62 3,25	30,83 3,18	0,862
Internal reflectance (24h) – LD	70,12 11,39	72,39 11,93	0,278
Drip loss (%) – LD	7,12 3,04	8,39 2,62	0,204
WHC (cm^2) – SM	0,37 0,07	0,35 0,07	0,220
PSE (%) – LD	13,64	23,53	0,009**

Pre-slaughter handling[a]; Lower stress: board; Higher stress: eletric prod.
***p<0,001; **p<0,01; *p<0,05;
PSE – L*>50, drip loss >5% e pH_u<6,0.

Table 2- Biochemistry Parameters in pig plasma according to the pre-slaughter handling applied.

	Pre-slaughter handling [a]		Significance
	lower stress	higher stress	
Cortisol (g/dL)	10,76 5,76	16,32 5,50	0,0004***
Lactate (mg/dL)	80,26 41,38	189,214 72,06	0,0001***

Pre-slaughter handling [a]; lower stress – board; higher stress – electric prod.
***p<0,001.