

THE EFFECT OF TRANSPORT VEHICLE, LAIRAGE, AND HARVEST DAY ON PORK QUALITY

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Introduction

Preslaughter handling of pigs, including stockman interaction (loading, unloading, driving animals), transport, and lairage, has been designed to meet the pork industry's requirements rather than the pig's needs. Various preslaughter handling such as transport (Warris and Bevis, 1986), lairage (Brown *et al.*, 1999), and preslaughter stress (Hambrecht *et al.*, 2004) can trigger a stress response and may have negative consequences for pork quality aspects such as colour, water-holding capacity, and other sensory characteristics. Warris (1998) and Gispert *et al.*, (2000) found that pigs transported for long periods of time are more likely to form dark-firm-dry pork because of exhaustion and fatigue. Bradshaw *et al.*, (1996) found that short (≤ 1 h) compared with long transports were more detrimental because the pigs did not recover from the stress of loading and could not adapt to the conditions of transport. The effect of lairage duration depends on factors such as environmental temperature and mixing. Aaslyng and Gade (2001) found that a lairage time of less than one hour does not allow for sufficient resting and may negatively impact both animal welfare and meat quality. However, extended lairage times of six hours and more may increase carcass damage and stress caused by fighting and prolonged periods without feed (Warris, 1998). The negative factors associated with transport, lairage, and preslaughter stress increase the chances of economic losses to producers and packers.

Materials and Methods

Mixed market hogs (Pig Improvement Company, Franklin KY) from the same commercial farm were harvested via electrical stunning in four groups on two days. Animals were harvested during a week in February at a processing plant in the northern Midwest. Pigs ($n = 639$) were randomly assigned to one of eight treatments in a $2 \times 2 \times 2$ factorial arrangement, with two transport vehicle animal locations (top deck or bottom deck), two transport times (short (< 3 h) or long (6 h)), and two lairage durations (long (6 h) or short (< 3 h)). Four groups of pigs were processed over one week during the winter at a commercial plant. At 24h postmortem, loins were collected for ultimate meat quality. Measurements were taken at the 10th/11th rib interface of the longissimus muscle (LM). L^* (lightness), a^* (redness), and b^* (yellowness) colour values were assessed in the LM on a freshly cut surface after a 10 minute blooming period with a Minolta Portable Chroma Meter (Model CR 210) calibrated to a black and white tile standard with a D_{65} illuminant. Both colour saturation (chroma; $[a^{*2} + b^{*2}]^{0.5}$) and hue angle (true red; $\arctangent(b^*/a^*) \times [360^\circ / 2 \times 3.14]$) were calculated. pH was measured at the 10th rib location of the LM using an MPI pH meter (Meat Probes). Drip loss samples were collected from a 2.54cm thick loin chops using a 2.54cm diameter coring device. Samples were weighed, placed in drip loss tube (meat juice containers, C. Christensen Laboratory, Denmark) and stored at 2°C. After 24h of storage samples were re-weighed for calculation of drip loss percentage. Data were analyzed by the General Linear Model (GLM) procedure of SAS (v. 9.1, SAS Inst., Inc., Cary, NC).

Results and Discussion

Results are printed in Table 1. Pigs from the coldest collection day (Thursday) had lower ($P < 0.01$) ultimate pH values and tended ($P = 0.06$) to be lighter in colour than pigs from the Tuesday harvest. However, pigs harvested on Thursday had an unusually lower ($P < 0.01$) drip loss percentages than pigs harvested on Tuesday. Additionally, drip loss was significantly ($P < 0.01$) increased for pigs on the bottom deck versus top deck. Short transport and short lairage increased ($P < 0.01$) paleness (i.e. high L^* values) and decreased a^* (redness) values in the longissimus. Colour saturation was decreased ($P < 0.01$) in the short lairage treatment and also on the cold day collection group. Hue Angle was decreased ($P < 0.01$) in the short transport group. These data suggest that longer transport or lairage times can allow pigs to adjust to the increased stress of loading and mixing animals.

Table 1: Least squares means (standard errors) for fresh pork loin quality measurements associated with time in transport, trailer deck level, length of lairage and harvest day.

Variable	Time in Transport ^a			Deck Level ^b			Time in Lairage ^c			Harvest Day ^d		
	Long	Short	P-val	Bottom	Top	P-val	Short	Long	P-val	Tues	Thurs	P-val
pH	5.64 (0.009)	5.63 (0.009)	0.57	5.63 (0.009)	5.64 (0.009)	0.32	5.62 (0.008)	5.65 (0.009)	< 0.01	5.72 (0.010)	5.55 (0.008)	< 0.01
Drip, %	2.97 (0.166)	3.18 (0.168)	0.37	3.39 (0.159)	2.76 (0.174)	< 0.01	3.07 (0.159)	3.08 (0.174)	0.98	3.34 (0.181)	2.81 (0.152)	< 0.05
L*	53.08 (0.159)	53.65 (0.159)	0.01	53.51 (0.153)	53.22 (0.164)	0.20	53.69 (0.151)	53.04 (0.165)	< 0.01	52.95 (0.173)	53.79 (0.145)	0.06
a*	16.53 (0.055)	16.45 (0.056)	0.30	16.54 (0.053)	16.44 (0.057)	0.21	16.38 (0.053)	16.59 (0.058)	< 0.01	16.61 (0.060)	16.37 (0.050)	< 0.01
Saturation	17.89 (0.056)	17.88 (0.056)	0.92	17.94 (0.054)	17.83 (0.058)	0.18	17.77 (0.054)	18.00 (0.059)	< 0.01	18.01 (0.061)	17.75 (0.051)	< 0.01
Hue Angle	22.34 (0.155)	22.96 (0.156)	< 0.01	22.64 (0.149)	22.66 (0.160)	0.94	22.69 (0.148)	22.62 (0.161)	0.75	22.66 (0.169)	22.65 (0.141)	0.96

^aLong = 6 h transport duration; Short = 3 h transport duration

^bTrailer description

^cShort lairage = <3h; Long lairage = 6h

^dTuesday February 14 and Thursday February 16.

Conclusions

The preslaughter time period is crucial in preserving ultimate meat quality. Environment, transport, and lairage all play a significant role in contributing to factors that decrease both ultimate pork quality and good economic returns. In the present study improved meat quality can be obtained from animals that are allowed adequate recovery time from either short transport or short lairage. Furthermore, because of the decrease in meat quality seen from the coldest collection day, it may be necessary to modify the transport vehicle or lairage environment so that animals are not exposed to harsh environmental factors that ultimately result in poor meat quality.

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