Stress responses and Meat Quality of Pigs Transported in a Pot-Belly Truck During Summer and Winter

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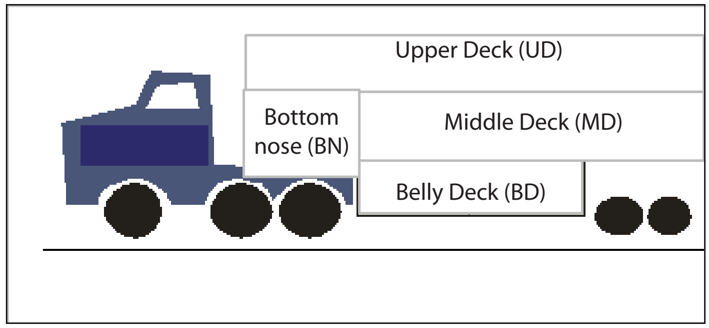

SUMMARY

Pigs transported in the bottom nose compartment of a conventional pot-belly trailer experienced greater stress than did pigs in other compartments, and this resulted in differences in meat quality. Pigs loaded into the bottom nose had to negotiate two ramps within the truck, first going up to the top deck, and then down to their compartment. As a result their heart rates were higher at the time of loading and, in the winter trials, remained so during the entire transport period. These pigs had higher lactate levels when exsanguinated at the plant, indicating an activation of energy sources, but a higher ultimate pH in several muscles suggesting that energy stores had been depleted during the travel. The meat from these pigs showed signs of the dark, firm and dry condition generally indicative of an extended period of stress.

INTRODUCTION

Pigs are exposed to a large number of potential stressors during transport, and at a time that could have a significant effect on the meat quality, and therefore value, of the animals' carcass. Producers in western Canada may face greater challenges transporting their pigs than other regions due to the long distances involved and the extremes of conditions in winter and summer. Although some producers are transporting their pigs on single purpose vehicles, many use dual purpose trailers designed to accommodate either pigs or cattle. Loading and unloading pigs from dual purpose pot-belly trucks involves moving pigs up and down several steep internal ramps, depending upon the compartment involved. This study was conducted to examine some physiological indicators of stress and meat quality in pigs transported in different compartments of a pot-belly truck in summer and winter from Saskatoon to Brandon.

EXPERIMENTAL PROCEDURES

In two seasons, summer and winter, a total of 1,170 market pigs were transported during six weeks every season in a pot-belly trailer, from Saskatoon to Brandon (approximately 8 hrs). Nine compartments in the trailer were used, and these were categorized by the ramp usage required during loading and unloading. Pigs in the middle deck (MD) did not have to use an internal ramp. Pigs in the belly (BD) had to descend a ramp during loading and ascend the ramp when unloading. Pigs in the upper deck (UP) ascended a ramp during loading, and descended it at the packing plant. Finally, pigs in the bottom nose (BN) compartment had to ascend and then descend ramps during both loading and unloading. On each load of pigs (195 pigs/week), 30 animals, individually identified, were equipped with monitors that recorded heart rate from the barn until arrival at the plant and were used to determine lactate levels at exsanguination. An additional 15 pigs were identified to evaluate meat quality for a total of 45 pigs every week. These subsets of animals were distributed throughout the compartments of the trailer. All pigs were fasted 8-9 hours before loading (21 hours before slaughter), and kept in lairage for 1.5 hours at the plant before stunning by cardiac arrest and exsanguination. Following slaughter, pigs were eviscerated, their carcasses split, and blast chilled for 2 hours. The carcasses were cut the following day.

"Pigs transported in the bottom nose portion of a pot-belly trailer showed the greatest degree of stress due to the amount of ramps the pigs had to use during loading and unloading"

Pork quality was assessed by muscle pH taken at 6 h and 24 h (pHu) in the longissimus dorsi muscle, in the semimembranosus muscle and in the adductor muscle at 24 h, and light reflectance and drip loss taken at 24 h post-mortem in the longissimus dorsi and semimembranosus muscles.

Separate analyses were conducted for winter and summer, to determine differences among compartments within each season.

RESULTS AND DISCUSSION

During summer, pigs loaded in the BN presented higher heart rate at loading compared to those located in the BD ($P<0.05$), with those of pigs loaded in the MD and UD being intermediate. During the waiting at loading, pigs from the BN showed a lower heart rate compared to pigs loaded in the other compartments ($P<0.05$), as they were the first to load and had longer to recover from loading stress before departure. Overall, during transport, pigs loaded in the UD and MD had higher heart rates compared to those transported in the BD ($P<0.05$), with those of pigs in the BN being intermediate. Blood lactate levels at exsanguinations were higher in pigs transported in the BN compared to pigs loaded in the other compartments ($P<0.05$). The higher heart rate and lactate levels may indicate the higher physical effort of pigs to negotiate the very steep ramp (32°) giving access to the BN. Meat quality was somewhat affected by this physical effort as shown by the higher pHu value in the adductor muscle and lower drip loss in the semimembranosus muscle ($P<0.05$).

During winter, pigs loaded in the BN showed a higher heart rate at loading compared to pigs in the MD ($P<0.05$), with the other compartments being intermediate. The initial stress shown by pigs in the different compartments during loading was reflected in the overall heart rate of pigs during transport. Similarly, blood lactate levels were higher in pigs transported in the BN compared to those in the MD ($P<0.05$). Meat quality was also affected by animal location during transport in winter with pigs transported in the BN showing higher pHu values and lower drip loss levels in the longissimus dorsi and adductor muscles ($P<0.05$). High pH values and low drip losses indicate that these pigs are prone to the form of poor meat quality referred to as dark, firm and dry. This usually indicates an extended period of stress pre-slaughter, resulting in depleted glycogen stores post-mortem.of moving pigs into and out of such compartments.

IMPLICATIONS

This study confirms that the design of the pot-belly trailer, commonly used for pig transport, imposes a certain level of stress related to the use of multiple steep internal ramps at loading and unloading. In this case, with a dual-purpose pot-belly truck, the bottom nose compartment evidenced the greatest degree of stress. Additional studies are planned to determine means of reducing the stress of moving pigs into and out of such compartments.

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Meat Quality Assessment of Pork

A pig wearing a belt with the heart rate monitor installed

Table 1. Summer

Compartment	Upper Deck	Bottom Nose	Middle Deck	Belly Deck	Significance [x]	SEM
N	101	30	57	69		
Longissimus dorsi						
pH 6h	6.03	5.98	6.02	6.02	NS	0.05
pH 24h	5.65	5.67	5.61	5.62	NS	0.03
L*	49.37 ^{a}	48.33 ^{b}	48.87 ^{ab}	49.62 ^{a}	*	0.37
Drip loss (%)	3.88 ^{ab}	3.51 ^{b}	4.29 ^{a}	4.44 ^{a}	*	0.32
Semimembranosus						
pH 6h	6.29	6.30	6.35	6.34	NS	0.05
pH 24h	5.62 ^{b}	5.67 ^{a}	5.62 ^{B}	5.66 ^{ab}	*	0.02
L *	47.13 ^{a}	46.10 ^{b}	47.18 ^{a}	46.26 ^{b}	*	0.35
Drip loss (%)	3.94 ^{a}	2.85 ^{b}	3.80 ^{a}	3.84 ^{a}	*	0.28
Adductor						
pH 24h	5.82 ^{b}	5.90 ^{a}	5.77 ^{b}	5.79 ^{b}	*	0.03
Lactate (mmol/L)	10.86 ^{b}	12.51 ^{a}	9.04 ^{c}	10.11 ^{bc}	*	0.91

[x] NS : Not significant; * : $P < 0.05$
[y] According to Japanese Color Scales (from 1 = pale to 6 = dark; Nakai et al., 1975)

Table 2. Winter

Compartment	Upper Deck	Bottom Nose	Middle Deck	Belly Deck	Significance *	SEM
N	83	25	47	60		
Longissimus dorsi						
pH 6h	6.05	6.01	6.03	5.98	NS	0.07
pH 24h	5.73 ^{b}	5.83 ^{a}	5.71 ^{b}	5.71 ^{b}	*	0.03
L*	49.21	48.26	49.30	48.65	NS	0.80
Drip Loss (%)	3.53 ^{a}	2.90 ^{b}	3.50 ^{a}	3.25 ^{ab}	*	0.24
Semimembranosus						
pH 6h	6.08	6.12	6.03	6.09	NS	0.07
pH 24h	5.70 ^{b}	5.85 ^{a}	5.68 ^{b}	5.72 ^{b}	*	0.03
L *	46.58	45.58	46.14	45.66	NS	0.51
Drip loss (%)	4.40 ^{a}	3.28 ^{b}	4.14 ^{a}	4.08 ^{a}	*	0.26
Adductor						
pH 24h	5.99 ^{b}	6.15 ^{a}	5.92 ^{b}	6.06 ^{ab}	*	0.05
Lactate (mmol/L)	13.63 ^{b}	15.92 ^{a}	11.13 ^{c}	13.60 ^{b}	*	0.97

[x] NS : Not significant; * : $P < 0.05$
[y] According to Japanese Color Scales (from 1 = pale to 6 = dark; Nakai et al., 1975)