

Effects of Pen Size on the Stress Response at Loading and Unloading and Transport Losses from Market Weight Pigs

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Summary and Implications

The objective of this study was to determine the effects of pen size on stress responses (during loading and unloading) and transport losses at the packing plant. This study took place between July and August. Twenty-six loads of split sex market weight pigs ($n = 4,522$) from three conventional grow-finish sites were used in a randomized complete block design. Each site had two rooms with both treatment groups represented in each room. The small pen (SP) treatment had 36 pigs/pen ($0.59\text{m}^2\text{pig}^{-1}$). The large pen treatment (LP) had 324 pigs/pen ($0.59\text{m}^2\text{pig}^{-1}$). Both pen size treatments were sorted from pen mates at the time of marketing. Pigs were moved in groups of four to six using sort boards and electric prods, when necessary. Treatments were randomly assigned to a trailer deck ($\sim 0.42\text{m}^2\text{pig}^{-1}$). Straight deck trailers were used and pigs were transported ~ 1 h to a commercial harvest facility. During loading and unloading, the number of pigs displaying open mouth breathing (OMB), skin discoloration (SD), and muscle tremors (MT) were recorded. At the plant, dead and non-ambulatory pigs were recorded during unloading, and total losses were defined as the sum of dead and non-ambulatory pigs at the plant. Data was analyzed using Proc Glimmix of SAS. Statistical analysis could not be run on the incidence of muscle tremors or non-ambulatory pigs at loading or injured and dead on arrival (DOA) at the harvest facility because there were too many zeros in the dataset. Incidence of MT was 0.04% SP and 0.00% LP and there were no non-ambulatory pigs at loading from either treatment. Incidence of injured pigs was 0.00% SP and 0.04% LP. There were no DOA's in either treatment. SP pigs had lower OMB ($P = 0.0015$) and SD ($P = 0.0120$) during loading compared to LP pigs. At unloading SP displayed higher ($P < 0.0001$) SD than LP. No ($P > 0.05$)

differences existed between treatments for OMB, MT, fatigued, total non-ambulatory, or total losses existed. In conclusion, pen size did not impact the incidence of transport losses.

Introduction

The term "transport losses" refers to pigs that die or become non-ambulatory (fatigued or injured) at any stage of the marketing process, defined as movement from the grower-finisher environment to stunning at the abattoir. In 2006, transport losses were estimated to cost the U.S. swine industry \$46 million. The etiology of transport losses is a multi-factorial problem, involving the pig, people, facility design, transportation and season. Reducing or eliminating one of these potential stressors placed upon a pig at the time of marketing may reduce the incidence of transport losses. While still in need of additional study, large pens are thought to provide benefits by allowing the pig to avoid more aggressive pigs and select its own microenvironment. Little is known; however, about the effect these large pens have on transport losses at the time of marketing. Therefore, the objective of this study were to determine the effects of pen size on stress responses at the time of loading and unloading and transport losses in the market weight pig.

Materials and Methods

Animals and Location: This project was approved by the Iowa State University Institute for Animal Care and Use Committee. A total of 4,522 finisher pigs (crossbred commercial) were used and data collection occurred from July 26th to August 29th, 2009 in Iowa.

Housing: Research was conducted on three commercial grow-finisher sites at a Midwest integrator. All sites were identical in their system design, were equipped with natural ventilation systems which included side-curtains and had the same management. Pigs were checked daily (between 0800 and 1100 h) to ensure the health of the pigs and maintenance of the facility. Pens (7.3 m long x 2.9 m wide) were divided by metal piping gates (0.9 m high) and pens had cement slatted flooring (2.5 cm wide x 131.5 cm long). Feed was delivered on demand to a wet / dry feeder (1.4 m high x 43.2 cm wide x 1.5 m long; with a 12 cm deep pan). All pigs were fed a standard finishing diet that met the pigs' requirements (NRC, 1998) and water flow rates were 1.5 L/min, which is within the recommended guidelines for grow-finish pigs (Iowa State University Extension, 1992).

Treatments: Each finisher site had two, 1200 hd rooms. Within each room, one side of the aisle was set-up with the small pen treatment (SP), while the other side was set-up

with the large pen treatment (LP). Therefore, both treatments were represented in each room. The small pen configuration housed 36 pigs/pen; providing 0.59 m² of floor space. The large pen configuration housed 324 pigs/pen; providing 0.59m² of floor space. For LP the back gates of nine consecutive pens were opened allowing pigs' access to nine pens. Space was not adjusted after first pull, so pigs in both treatments would have higher floor space allowances as pigs were removed from the facility. Pens were split sex by room at each site so males were housed in rooms with males and females were in rooms that contained only females. When pigs had reached targeted market weight a caretaker marked those pigs were marked on the back using an animal safe spray marker (Prima Spray-on, Prima Tech, NC, USA) 2-d prior to loading. Immediately prior to loading, all swing gates in LP were closed and pigs were divided into smaller groups. In both treatments, marked pigs were sorted from pen mates at the time of marketing by the same four person crew.

Pig Handling and Loading: A total of 26 semi-loads transported these pigs from the grow-finisher site to a packing plant. Pigs were moved in groups of four to six from their home pen to the semi, using sort boards and electric prods, when necessary, by the same four man loading crew. Average load weight per pig was 122 ± 10.6 kg. Pigs were 199 ± 9 d of age at the time of marketing.

Trucks, Trailers, and Transport Conditions: The trailers used were owned and operated by the integrator. All trailers used in the study were of similar design and dimensions. Trailers were a straight floor, double deck trailer composed of aluminum. Each trailer was divided into 4 upper deck compartments and 5 lower deck compartments. The trailer's internal ramp was constructed of aluminum utilizing a diamond pattern for traction and wave type cleating spaced 20.3 cm. Cleats were 4.5 cm high and 5.1 cm wide. All compartments on the trailer were stocked according to the current standard operating procedure for this production system (~0.42 m² / pig; 174 pigs/load). After the truck was loaded, pigs were transported 84.8 ± 7.2 km to the packing plant. During loading, treatments were alternatively assigned to trailer decks and both facility designs were represented on each trailer load of pigs.

Stress Responses at Loading and Unloading: Stress responses were recorded by three trained observers during loading (one at the farm) and unloading (two at the plant). During loading and unloading, the number of pigs displaying open mouth breathing (OMB), skin discoloration (SD) and muscle tremors (MT) were recorded. At loading, the number of non-ambulatory, not loaded pigs was recorded. At the plant, dead and non-ambulatory pigs were recorded up until the pigs reached the weigh scale. Non-ambulatory pigs were the summation of fatigued or injured

pigs. Total losses were defined as the summation of dead and non-ambulatory pigs at the plant.

Statistical Analysis: The experimental unit was the trailer deck of finisher pigs (SP [n = 26] LP [n = 26]). PROC Glimmix (SAS) were used to analyze the data. Farm (three sites), date (seven days), load (26 loads) and treatment (SP vs. LP) were used in the class statement. The statistical model for the transport losses and stress responses of interest included treatment and the number of pigs loaded was used as a linear covariate. The random statement was farm nested within date and date by farm by trailer nested within load. Statistical analysis could not be run on the incidence of muscle tremors or non-ambulatory pigs at loading or injured and dead on arrival (DOA) at the harvest facility because there were too many zeros in the dataset. A *P* value of ≤ 0.05 was considered to be significant and I-Link was performed to transform values for means and standard errors.

Results and Discussion

At the time of loading at the farms, SP pigs had a lower percentage of OMB (*P* = 0.0015) and SD (*P* = 0.01) compared to LP pigs. Incidence of MT was 0.04% SP and 0.00% LP and there were no non-ambulatory pigs at loading from either treatment.

Table 1. Least squared means (SE) for physical signs of stress and non-ambulatory pigs at the time of loading from the farm.

Measure, %	Treatment		P-values
	SP	LP	
OMB	18.2±0.1	22.9±0.1	0.0015
SD	22.7±0.1	26.4±0.1	0.0120

At the plant there were no (*P* > 0.05) differences for OMB and MT stress responses between treatments at unloading. However, SP pigs displayed more SD than LP pigs. There were no (*P* > 0.05) differences between treatments for fatigued, non-ambulatory, or total losses at the plant (Table 2).

Table 2. Least squared means (SE) for physical signs of stress and total losses at the time of marketing at the packing plant.

Measure, %	Treatment		P-values
	SP	LP	
OMB	4.2± 0.3	3.3± 0.36	0.13
SD	5.8±0.5	2.9±0.5	<0.0001
MT	0.3±0.5	0.3±.05	0.74
Non-ambulatory ^a	0.3±0.37	0.3±0.4	0.83
Injured	0.00	0.00	0.88
Fatigued	0.3±0.4	0.2±0.4	0.45
Total losses ^b	0.3±0.4	0.3±0.4	0.83

The LP treatment had two injured pigs (0.04%) and there were no injured pigs from SP. There were no DOA's in either treatment. In conclusion, pen size had no impact on the incidence of transport losses.

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