

Effects of Facility Design on the Stress Response of Market Weight Pigs during Loading and Unloading

A.S. Leaflet R2469

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Summary and Implications

The objective of this study was to determine the effects of finisher pig facility design on pig stress responses at the time of loading for the market weight pig. The new (NEW) design had 192 pigs / pen with internal swing gates that were used to manually pre-sort market weight pigs on the day before loading. Traditional (TRAD) design had 32 pigs / pen; it was not feasible to pre-sort market weight pigs prior to loading. During loading, treatments were alternatively assigned to trailer decks. Pigs were loaded onto straight deck trailers, provided with $\sim 0.41 \text{ m}^2$ / pig and were transported ~ 1 h to a commercial plant. 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 non-ambulatory pigs were classified as fatigued (stress-related) or injured. Total losses were defined as the sum of dead + non-ambulatory pigs at the plant. Data were analyzed by Proc Glimmix of SAS. NEW pigs had lower ($P \leq 0.05$) percentages of OMB, SD and MT during loading and unloading compared to TRAD pigs. NEW pigs had fewer ($P < 0.05$) dead pigs (0.01 vs. 0.23 ± 0.05 %), total non-ambulatory pigs (0.29 vs. 0.66 ± 0.12 %) and total losses (0.30 vs. 0.89 ± 0.14 %) at the plant compared to TRAD pigs. In summary, utilizing large pens and pre-sorting prior to loading, reduced physical signs of stress during loading and unloading, and reduced total losses at the plant by 66 % compared to pigs from traditional pens.

Introduction

Animal transportation losses are a critical problem around the world. These losses are often attributed or labeled transportation losses. In reality a significant portion of these losses are related to the way the animal was handled prior to / during the load out process, and the design of the load out facilities. The consequences of poor finisher pig handling and system design flaws can be seen through a variety of welfare and economical measurements. For

example, market pig “mortalities” that occur during shipment from the farm to the processing plant, termed “dead on arrival” (DOA), and mortalities at the harvest facility, typically referred to as “dead in plant” (DIP) have been estimated to cost the US pork industry \$55,464,500 annually. The objective of this study was to determine the effects of finisher pig facility design on pig stress responses at the time of loading for the market weight pig.

Materials and Methods

Housing and animals: A total of 5901 finisher pigs (crossbred commercial) were used for this study. Pens were mixed sex. Data collection occurred from June 7th to July 19th, 2007. This project was approved by the Iowa State University Institute for Animal Care and Use (IACCU). Research was conducted on three commercial finisher farm sites at a Midwest integrator. All sites were identical in their system design, had the same management, feed and water delivery systems. Pigs were housed in standard finisher style housing. Pens (7.32 m x 2.93 m) were divided by metal piping gates (0.88 m high). Flooring was cement slated (2.54 cm x 131.45 cm). All sites were equipped with natural ventilation systems which included side-curtains. Pigs were checked daily during the morning (0800 h) to ensure health of the pigs and maintenance of the facility. Pigs had ad libitum access to feed and water during the grow-finish period. All pigs were fed a standard finishing diet (CP 14.57 %; ME 720 kcal / kg; Lysine 0.74 %) that met or exceeded the pigs’ requirements (NRC, 1998). Feed was delivered on demand to a wet / dry feeder (1.4 m high x 43.18 cm wide x 1.52 m long; with a 12 cm deep pan).

Treatments: Each finisher site had two, 1200 head rooms. Within each room, one side of the aisle was set-up with the traditional facility design (TRAD; Figure 1), while the other side was set-up with the new (NEW; Figure 2) facility design. Therefore, both treatments were represented in each room. TRAD; Pigs were housed 32 pigs per pen, providing 0.67 m^2 per pig of floor space. Space was not adjusted after first pull, and thus both treatments would have higher floor space allotment as pigs were removed from the facility, as is traditional. In TRAD pens, marked pigs were sorted from pen mates during loading by the loading crew.

Figure 1. TRAD system.



NEW; back gates of four consecutive pens were opened allowing the pigs access to 6 pens at a space allowance of 0.67 m² per pig. This resulted in 192 pigs being housed in one large pen. Pigs in this treatment were presorted the day prior to loading. Pigs were sorted into one of the middle pens from the set of six consecutive pens. This design confounds the effects of facility design with pen size and pre-sorting, but this is how the two facility designs are being utilized under commercial conditions.

Figure 2. NEW system.



In both treatments the pigs were marked on the back by the general manager of the facility using an animal safe spray marker (Prima Spray-on, Prima Tech, NC, USA) one day prior to loading so treatments could be tracked from the pen to the weigh scale at the packing plant.

Pig Handling and Loading: Pigs were moved from one of three finisher sites in the Midwest to a commercial packing plant over 33 loads. Average load weight per pig was 116.27 kg. Pigs were 203 ± 18 d of age at the time of marketing. Pigs were moved from the pen to the chute by the same five man loading crew.

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 trailers internal ramp was constructed of aluminum utilizing a diamond pattern for traction and wave type cleating spaced 20.32 cm. Cleats were 4.45 cm high and

5.08 cm wide. All compartments on the trailer were stocked according to the current standard operating procedure for this production system (~0.41 m²/ pig; 180 pigs / load). After the truck was loaded, pigs were transported 84.81 ± 7.16 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 four trained observers during loading (two 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 pigs and the number of pigs not loaded were recorded. At the plant, dead and non-ambulatory pigs were recorded up to the weight scale. Non-ambulatory pigs were classified as fatigued or injured. Total losses were defined as the sum of dead and non-ambulatory pigs at the plant.

Statistical Analysis: The experimental unit was the trailer deck of finisher pigs (TRAD [n = 33] NEW [n = 33]). PROC Glimmix (SAS) were used to analyze the data. Farm (three sites), date (eight days), load (33 loads) and treatment (TRAD vs. NEW) were used in the class statement. The statistical model main plot included the performance and welfare parameters of interest 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. 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

Results: NEW pigs had lower (*P* ≤ 0.05) percentages of OMB, SD and MT during loading and unloading compared to TRAD pigs (Tables 1 & 2). NEW pigs had fewer (*P* < 0.05) dead pigs (0.01 vs. 0.23 ± 0.05 %), total non-ambulatory (0.29 vs. 0.66 ± 0.12 %) and total losses (0.30 vs. 0.89 ± 0.14 %) at the plant compared to TRAD pigs (Table 2).

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Table 1. Least squared means and standard errors for treatment on physical signs of stress and losses at the time of marketing from the farm. Number of head per trailer deck was used as a linear covariate.

Measure, %	Treatment		P-values
	TRAD	NEW	
OMB	30.07 ± 4.20	22.59 ± 3.19	< 0.0001
SD	16.39 ± 4.30	12.98 ± 3.41	0.0005
MT	0.73 ± 0.14	0.33 ± 0.14	0.0292
Non-ambulatory	0.07 ± 0.04	0.02 ± 0.02	0.20
Not loaded	0.05 ± 0.03	0.02 ± 0.01	0.40

Conclusions: In summary, utilizing large pens and pre-sorting prior to loading, reduced physical signs of stress during loading and unloading, and reduced total losses at the plant by 66 % compared to pigs from traditional pens.

Table 2. Least squared means and standard errors for treatment on physical signs of stress and total losses at the time of marketing at the packing plant. Number of head per trailer deck was used as a linear covariate.

Measure, %	Treatment		P-values
	TRAD	NEW	
OMB	14.02 ± 3.80	8.64 ± 2.36	< 0.0001
SD	3.61 ± 0.92	2.06 ± 0.55	0.0007
MT	0.61 ± 0.16	0.30 ± 0.10	0.05
Dead	0.23 ± 0.09	0.01 ± 0.00	0.0059
Total non-ambulatory	0.66 ± 0.14	0.29 ± 0.09	0.04
Injured	0.20 ± 0.08	0.07 ± 0.05	0.17
Fatigued	0.45 ± 0.12	0.22 ± 0.08	0.11
Total losses	0.89 ± 0.18	0.30 ± 0.09	0.0031

Acknowledgements

Support was provided by Iowa Select Farms, Swift Packing Plant, Elanco Animal Health and ISU Animal Science start up funds.