

Facility design and transport: the welfare connection

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Areas to Discuss

- Define transport losses in market weight pigs
- Background
 - Incidence of transport losses in U.S.
 - Summary of pre-disposing factors for transport losses
 - Discussion of facility design factors
- Controlled study on facility design and transport losses



Transport Losses: Definitions

- Dead on arrival (DOA):
 - A pig that died during transport
- Dead in Yard (DIY) or Dead in Pen (DIP)
 - A pig that died after unloading (usually in the lairage pen)
- Non-ambulatory pig:
 - A pig unable to move or keep up with contemporaries
 - Downers, subjects, slows, suspects, cripples, stressors, fatigued, injured
- Transport losses:
 - The sum of dead and non-ambulatory pigs at the plant



Classifying Non-ambulatory Pigs



Fatigued
(Stress related)



Injured
(Structure/injury related)

Ellis, M. F., McKeith, and M. Ritter. 2004. Handling Non-Ambulatory Pigs. Proceedings of the International Meat Animal Welfare Research Conference, Kansas City, MO.



U.S. Incidence of Transport Losses

- Dead pigs at the plant
 - 2008 national statistics: 0.20% (FSIS, 2009)
- Non-ambulatory pigs at the plant
 - Data summarized on 23 field trials in the U.S. (Ritter et al., 2009)
 - Non-ambulatory pigs prior to weigh scale: 0.44%
 - Majority of non-ambulatory pigs classified as fatigued



FSIS. 2009. Market swine condemned ante-mortem for deaths in USDA inspected plants for the calendar year of 2008. FOIA Case #09-00071.
Ritter, M. J., M. Ellis, N. L. Berry, S. E. Curtis, L. Anil, M. Benjamin, D. Butler, C. Dewey, B. Driessen, P. DuBois, J. Hill, J. Marchant-Ford, P. Matra, J. McGlone, P. Morimoto, T. Meyer, K. Platzgraf, J. Salak-Johnson, J. Sterle, C. Stull, T. Whiting, B. Wolter, S. R. Nickamp, and A. K. Johnson. 2009. Transport losses in market weight pigs: I. A review of definitions, incidence and economic impact. *Prof. Anim. Sci.* (submitted)



Summary of Pre-disposing Factors

- It is well established that transport losses are increased by:
 - Aggressive handling with electric prods
 - Porcine stress syndrome (stress gene)
 - Crowding pigs during transport
 - Extreme weather conditions
- However, relatively little is known about the impact of facility design on transport losses

Ritter, M. J., M. Ellis, N. L. Berry, S. E. Curtis, L. Anil, M. Benjamin, D. Butler, C. Dewey, B. Driessen, P. DuBois, J. Hill, J. Marchant-Ford, P. Matra, J. McGlone, P. Morimoto, T. Meyer, K. Platzgraf, J. Salak-Johnson, J. Sterle, C. Stull, T. Whiting, B. Wolter, S. R. Nickamp, and A. K. Johnson. 2009. Transport losses in market weight pigs: I. A review of definitions, incidence and economic impact. *Prof. Anim. Sci.* (submitted)



Facility Design

- Facility design has important implications for:
 - Preparing pigs for transport
 - Ease of pig handling
 - Injuries and carcass bruising
 - Transport losses



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Key Components of Facility Design

- ✓ Pen design
- ✓ Pre-sorting pens
- ✓ Aisle width
- ✓ Distance moved
- ✓ 90° turns
- ✓ Air flow patterns
- ✓ Lighting
- ✓ Flooring
- ✓ Distractions
- ✓ Chute design

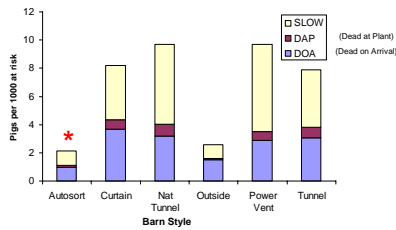


Hill, J., N. Berry and A. K. Johnson. 2007. Marketing the finisher pig: The impact of facility design. Pork Information Gateway. FIG 09-08-01.

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Recent Field Data – Facility Design

- Rademacher & Davies, 2005
 - Data based on ~1.3 million pigs marketed in the Midwest



Rademacher, C., and P. Davies. 2005. Factors associated with the incidence of mortality during transport of market hogs. Pages 186-191 in Proceedings of the Allen D. Leman Swine Conference. St. Paul, MN.

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Large Pens and Pre-sorting

- Potential advantages
 - Pigs have more room to exercise during the grow-finish period
 - Pre-sorting allows pigs an opportunity to recover from the stress of being sorted from pen mates
 - Pre-sorting reduces distance moved from pen to truck
 - Feed withdrawal can be implemented on all pigs
 - Little to no mixing of unfamiliar pigs during transport

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Controlled Field Study

Investigators:

Iowa State University
Iowa Select Farms
JBS Swift & Co.
ELANCO Animal Health

Objectives:

To determine the effects of facility design on stress responses (during loading and unloading) and transport losses at the packing plant in market weight pigs

Johnson, A. K., L. J. Sadler, L. M. Geising, C. Feuerbach, H. Hill, M. Figs, R. Bailey, K. J. Sadler, and M. J. Ritter. 2009. Effects of facility design on the stress responses of market weight pigs during loading and unloading. J. Anim. Sci. (Submitted)

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Experimental Design

- This study utilized 33 trailer loads of market weight pigs in a randomized complete block design with two facility design treatments:
 - 1). Small pens (pens of 32, sorted during loading)
 - 2). Large pens (pens of 192, pre-sorted on the day before loading)
 - Trailer deck was the experimental unit
 - The trailer load of pigs was the blocking factor
- *Note: this design confounds the effects of pen size with pre-sorting

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Facility Design Treatments

- Small pen design
 - 32 pigs/pen
 - Floor space = 7.21 ft²/pig (0.67 m²/pig)
 - Not feasible to pre-sort market weight pigs prior to loading



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Facility Design Treatments

- Large pen design
 - 192 pigs/pen, floor space = 7.21 ft²/pig (0.67 m²/pig)
 - Utilized swinging gates between the feeder and the wall
 - Back gates of four consecutive pens were opened to combine 6 pens
 - Internal swing gates were used to manually pre-sort market weight pigs on the day before loading



(Swing gates closed)

Swinging Gates

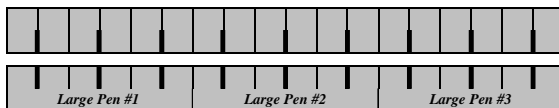


(Swing gates open)

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Materials and Methods

- Study dates: June 7, 2007 to July 19, 2007
- Three commercial wean-to-finish sites were used in this study
- Facility design treatments were randomly assigned to one side of the aisle within each room at each site:



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Materials and Methods

- Pigs
 - 5,901 barrows and gilts
 - Average live weight = 256 lbs (116.3 kg)
 - Newsham genetics
- Feed and water
 - Pigs had *ad libitum* access to feed and water
 - All diets met or exceeded the pigs requirements (NRC, 1998)
 - Feed withdrawal was not implemented prior to loading

NRC. 1998. Nutrient Requirements of Swine. 10th ed. Natl. Acad. Press, Washington, DC.

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Materials and Methods

- The day before loading, market weight pigs were uniquely marked by treatment and marked pigs in large pens were pre-sorted
- Pigs were loaded by loading crews according to current commercial practices (sorting boards and electric prods, if needed)
- Facility design treatments were randomly assigned to trailer decks
- Trailers were loaded at 4.4 ft²/pig (0.41 m²/pig) and stocking density was standardized across decks
- Only straight deck trailers were utilized in this study

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Farm Observations

- Recorded by Iowa State University

- Handling characteristics
 - Loading time
 - Pigs not loaded onto top deck
- Physical signs of stress
 - Open-mouth breathing (OMB)
 - Skin discoloration (SD)
 - Muscle tremors (MT)
 - Non-ambulatory pigs



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Transportation

- After loading, pigs were showered or not showered at the driver's discretion
- Pigs were transported ~1 h to a commercial packing plant
- Each trailer was equipped with 2 Hobo data loggers to record temperature and relative humidity every 1 minute



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Plant Observations

- Monitored by Iowa State University

- Physical signs of stress
 - Open-mouth breathing (OMB)
 - Skin discoloration (SD)
 - Muscle tremors (MT)

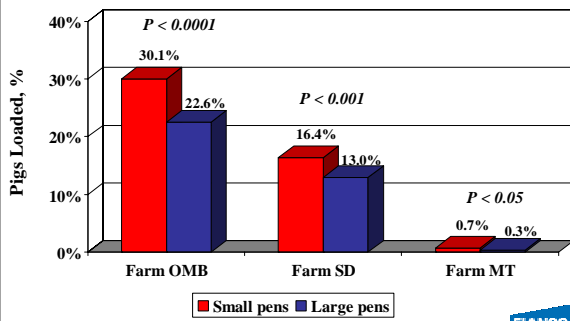


- Transport losses
 - Deaths on arrival (DOA)
 - Non-ambulatory
 - Fatigued vs. injured



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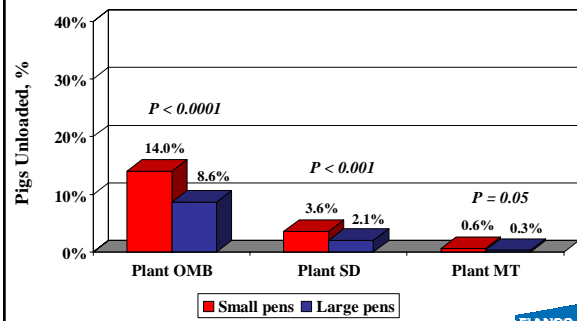
Physical Signs of Stress at the Farm



*Note: large pens were pre-sorted prior to loading and small pens were not.

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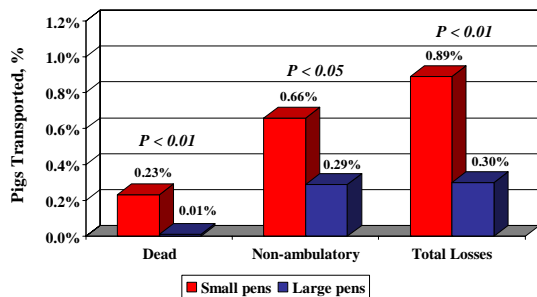
Physical Signs of Stress at the Plant



*Note: large pens were pre-sorted prior to loading and small pens were not.

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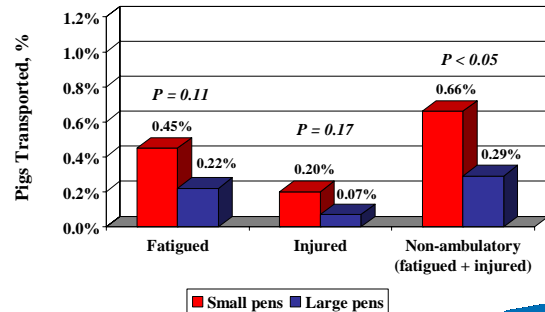
Transport Losses at the Plant



*Note: large pens were pre-sorted prior to loading and small pens were not.

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Non-ambulatory Pigs at the Plant



*Note: large pens were pre-sorted prior to loading and small pens were not.

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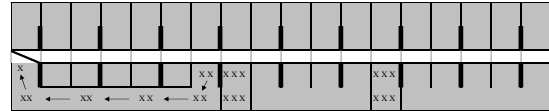
Summary

- Utilizing large pens and pre-sorting pigs 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 (small pens, sorted during loading)



Large Pen Design

- Other advantages not evaluated in this study:
 - Reduced distance moved from pen to truck (5 pens closer)
 - Ability to withdraw feed on all barn cuts (5 lbs of feed per pig)
 - Wider aisles during loading on barn close-outs



Next Steps

- Additional research is necessary to:
 - Determine if reduction in transport losses is due to pen size (192 vs. 32 pigs) and/or pre-sorting pigs the day before loading
 - Determine effects of grow-finish pen size on growth performance traits



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