Effects of pre-sorting and pen size on stress responses and transport losses in market weight pigs

L. Gesing*, A. Johnson†, K. Stalder†, J. Selsby†, M. Faga‡, C. Feuerbach‡, H. Hill‡, A. Whitey‡, R. Bailey‡ and M. Ritter‡

1Department of Animal Science, Ames, IA,
2Iowa Select Farms, Iowa Falls, IA,
3JBS Swift and Co., Marshalltown, IA,
4Elanco Animal Health, Greenfield, IN

Introduction

- Novelty can be a profound stressor to pigs (Grandin, 1997)
- Body has developed physiological mechanisms to adapt;
  - Acute (short-term)
  - Chronic (long-term) stressors
- How an individual pig copes with aversive stimuli can affect its performance and meat quality (Geverink et al., 1998; Hambrecht et al., 2004)

Additive stressor model

![Additive stressor model diagram](https://via.placeholder.com/150)

Pre-sorting

- Pre-sorting pigs into resting pens for 2-h prior to loading allowed;
  - Heart rate to return to baseline values
  - 25% reduction in transport deaths (Chevillon, 1998; 2000)
- Pre-sorting may minimize additive stressors at the time of loading

Objective

To determine the effects of pre-sorting on stress responses (during loading and unloading) and transport losses at the packing plant for market weight pigs

MATERIALS AND METHODS
Materials and Methods

- Study dates: December 23, 2008 to March 25, 2009
- Three commercial wean to finish sites used
- Facility design treatments were randomly assigned to one side of the aisle within each room at each site
- 5,802 mixed sex pigs
- Pigs 195 ± 16 d of age, 120.3 kg (265.2 lbs)

NON

- No pre-sorting (NON)
- ~292 pigs / pen
- Floor space = 0.65 m² / pig (7.21 ft² / pig)
- Back gates of 9 consecutive pens kept open to combine 9 small pens
- Not pre-sorted prior to loading; sorted at time of loading

PRE

- Pre-sorted (PRE)
  - ~292 pigs / pen
  - Floor space = 0.65 m² / pig (7.21 ft² / pig)
  - Back gates of 9 consecutive pens opened to combine 9 pens
  - Internal swing gates used to pre-sort market weight pigs

Pen design

- LARGE PEN, NOT PRE-SORTED
- LARGE PEN, NOT PRE-SORTED

Materials and Methods

- Two days prior to loading, market weight pigs were uniquely marked by treatment
- Marked pigs in PRE pens were pre-sorted approximately 18 h prior to loading
- Pigs were loaded by the same four man loading crew
- During loading, facility design treatments were randomly assigned to trailer decks

Trucks / Travel

- Only straight deck trailers were utilized
- Stocking density was standardized across decks 0.41 m² / pig (4.40 ft² / pig)
- Pigs were transported ~1 h to a commercial harvest facility in Iowa
Event times (in minutes)
- Loading
- Wait at farm
- Transport
- Wait at plant
- Unloading
- Loading time by treatment
  - Time the first pig in treatment stepped on truck until the last pig in treatment stepped on truck

Farm observations
- Physical signs of stress
  - Open-mouth breathing
  - Skin discoloration
  - Muscle tremors

Plant observations
- Physical signs of stress
  - Open-mouth breathing
  - Skin discoloration
  - Muscle tremors
- Transport losses
  - Dead on arrival (DOA)
  - Non-ambulatory
    - Fatigued and injured
  - Total losses (DOA + Non-ambulatory)

Classifying non-ambulatory pigs
- Fatigued (Stress related)
- Injured (Structure/injury related)

Experimental design
- Study utilized 33 trailer loads of market weight pigs
- Randomized complete block design
- Two treatments:
  - NON (not pre-sorted prior to loading)
  - PRE (pre-sorted 18 h before loading)
- Trailer deck was the experimental unit
- The trailer load of pigs was the blocking factor

Statistical Analysis
- Load time data was analyzed by PROC MIXED of SAS
- Model included the fixed effect of treatment and the random effects of site (date) and load (date x site x trailer)
- Number of pigs loaded was the linear covariate
- P – value of <0.05 considered significant
Statistical analysis

- Data were analyzed by PROC GLIMMIX of SAS
- Model included the fixed effect of treatment and the random effects of date (site) and load (date × site × trailer)
- Number of pigs loaded was used as a linear covariate
- A Poisson distribution was noted and an I-Link was used to transform values for means and standard errors
- P value of < 0.05 was considered to be significant

Statistical analysis

- DOA could not be run because too many zeros existed in the data set
- Will be presented descriptively

RESULTS

<table>
<thead>
<tr>
<th>Measure</th>
<th>MEAN</th>
<th>SD</th>
<th>MIN</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading, minutes</td>
<td>42</td>
<td>9</td>
<td>28</td>
<td>68</td>
</tr>
<tr>
<td>Wait at farm</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Transport</td>
<td>61</td>
<td>4</td>
<td>51</td>
<td>71</td>
</tr>
<tr>
<td>Wait at plant</td>
<td>22</td>
<td>23</td>
<td>3</td>
<td>98</td>
</tr>
<tr>
<td>Unload</td>
<td>25</td>
<td>13</td>
<td>11</td>
<td>53</td>
</tr>
<tr>
<td>Total Time</td>
<td>155</td>
<td>31</td>
<td>100</td>
<td>225</td>
</tr>
<tr>
<td>No. Loads within a day</td>
<td>3.3</td>
<td>1.3</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

Event times

<table>
<thead>
<tr>
<th>Measure</th>
<th>MEAN</th>
<th>SD</th>
<th>MIN</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>MEAN</td>
<td>SD</td>
<td>MIN</td>
<td>MAX</td>
</tr>
<tr>
<td>Loading, minutes</td>
<td>42</td>
<td>9</td>
<td>28</td>
<td>68</td>
</tr>
<tr>
<td>Wait at farm</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Transport</td>
<td>61</td>
<td>4</td>
<td>51</td>
<td>71</td>
</tr>
<tr>
<td>Wait at plant</td>
<td>22</td>
<td>23</td>
<td>3</td>
<td>98</td>
</tr>
<tr>
<td>Unload</td>
<td>25</td>
<td>13</td>
<td>11</td>
<td>53</td>
</tr>
<tr>
<td>Total Time</td>
<td>155</td>
<td>31</td>
<td>100</td>
<td>225</td>
</tr>
<tr>
<td>No. Loads within a day</td>
<td>3.3</td>
<td>1.3</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

Time to load by treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE</td>
<td>17.4</td>
</tr>
<tr>
<td>NON</td>
<td>21.7</td>
</tr>
</tbody>
</table>

Farm observations

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open mouth breathing</td>
<td>NON 12.25 ± 1.71</td>
<td>PRE 6.11 ± 0.91</td>
</tr>
<tr>
<td>Skin discoloration</td>
<td>NON 15.25 ± 3.67</td>
<td>PRE 8.08 ± 1.97</td>
</tr>
<tr>
<td>Muscle tremors</td>
<td>NON 0.17 ± 0.97</td>
<td>PRE 0.06 ± 0.14</td>
</tr>
<tr>
<td>Non-ambulatory</td>
<td>NON 0.03 ± 0.03</td>
<td>PRE 0.06 ± 0.04</td>
</tr>
</tbody>
</table>
Plant observations

<table>
<thead>
<tr>
<th>Measure, %</th>
<th>Treatment</th>
<th>( P )-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open mouth breathing</td>
<td>NON 0.28 ± 0.10</td>
<td>PRE 0.33 ± 2.36</td>
</tr>
<tr>
<td>Skin discoloration</td>
<td>NON 0.07 ± 0.05</td>
<td>PRE 0.11 ± 0.06</td>
</tr>
<tr>
<td>Muscle tremors</td>
<td>NON 0.26 ± 0.11</td>
<td>PRE 0.25 ± 0.11</td>
</tr>
</tbody>
</table>

DOAs

- 2 total pigs from PRE
- 0 total pigs from NON

Summary

- PRE pens loaded 4.3 min faster than NON
- PRE pens had reduced open mouth breathing and skin discoloration during loading
- At the harvest facility there were no differences in physical signs of stress or transport losses between treatments

Discussion

- Low overall incidences of transport losses (0.28% NON; 0.33% PRE)
- Average from 23 field trials is 0.69%
- Pre-sorting not a useful management tool on sites with already very low incidence of transport losses?

Thank you; Questions?

Thank you to Elanco Animal Health, Hatch, State of Iowa and the Department of Animal Science, Iowa State University for funding this project.