Effects of Handling Procedures and Transport Conditions on Welfare and Meat Quality of Pigs

Tina Widowski
Department of Animal & Poultry Science, University of Guelph
• ~31.5 million pigs were marketed in Canada in 2008 (Stats Canada)

• Most of these were transported to reach their end market

• Estimated 0.08 - 0.22% of them died before reaching their destination (Haley et al, 2008)

• Many more experienced non-fatal stress
Factors Affecting the Stress Response

- Genetics
- Experience
- Health
- Nutrition

- Ambient temperature
- Loading density
- Handling
- Mixing/grouping
- Transport lairage time
- Truck/facility design

...Multifactorial

Courtesy: M. Ellis
Pot-belly Truck
Recent & ongoing research

• Epidemiological studies on mortality
• Focused studies on behaviour, physiology and meat quality due to
  • Trailer design and transport conditions
  • Pigs and handling practices
In-Transit Losses

Researchers

- Charles Haley
- Cate Dewey
- Bob Friendship
  - Department of Population Medicine, Ontario Veterinary College, University of Guelph
- Tina Widowski
Factors Associated with In-Transit Losses of Market Pigs in Ontario 2001
(Haley et al, CJVR, 2008)

• Retrospective study of transport records from all pigs marketed in Ontario

• 4.76 million pigs from 4159 producers, marketed through 117 transport companies to 33 abattoirs in Canada and USA

• Pigs shipped to Ontario (82%), Quebec (13%), USA (4%), Manitoba (0.08%)
Factors Associated with In-Transit Losses of Market Pigs in Ontario 2001
(Haley et al, CJVR, 2008)

• In-transit loss = 0.017% (16.7/10,000 pigs)

• Farm of origin (25%) > abbatoir (16%) > transporter (8%) explained variance in losses

• Temperature-humidity index (combination of temperature and humidity) was highly predictive of losses
The highest losses in occurred in July 2003 - coincided with highest environmental temps (avg. 30.1°C)

From Charles Haley 2005
Pan-Canadian Pig Transport Project
Effects of Vehicle Design & Handling Procedures

RESEARCHERS:
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Luigi Faucitano (Lead), Agriculture Canada, Quebec
Renee Bergeron, Alfred College, Ontario
Trever Crowe, University of Saskatchewan
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Stephanie Torrey, Agriculture Canada, Quebec
Tina Widowski, University of Guelph

GRADUATE STUDENTS:
Jorge Correa, Laval University
Emily Toth, University of Guelph
Field Studies

Eastern Trials (Quebec)
Short hauls (2 hours)
June-July 2007 and Feb-March 2008
2 different trailer designs

Western Trials (Saskatoon to Brandon)
“Long” hauls (6 hours driving + 2 hours driver rest period)
Jan-Feb 2008 and June-July 2008
Eastern Trials (Quebec)
2 Trailer Designs

3-deck pot belly (V230)

2-deck hydraulic lift (10R)
Eastern Trials (Quebec)
2 Trailer Designs

- 6 weekly trials each season
- 313 pigs shipped each week (~118 kg)
iButtons were suspended from the ceiling in several locations within each compartment.
The iButton Data Logger

- Technology developed by Dallas SemiConductor™
- Used in poultry transport *(Crowe, unpublished data)*
- Used once in Missouri for pig transport *(Carr et al 2008,)*
- 17mm X 6mm stainless steel can
- 15 - 46°C range, 0.125°C accuracy
- 2048 loggings, adjustable timing
Behaviour
Behaviour
Behaviour
Behaviour
### Number of Pigs Sampled Weekly

14 + 28 = 42

<table>
<thead>
<tr>
<th>14 pigs</th>
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<table>
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<td>5</td>
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#### PB

- 10W
- 4
- 3
Heart Rate
Core Body Temperature

iButton administered orally and then recovered from viscera at slaughter
Blood Measures & Meat Quality

**Stress Measures**
- Creatine phosphokinase (CPK)
- Lactate
- Cortisol

**Loin & Ham**
- pH
- Lightness
- Drip Loss
- Meat Quality Classification
Data Collection Team
Data Collection
Preparation Procedure

Twelve hours prior to loading pigs were:
- weighed
- belted for heart rate measurement
- iButton administered
- ear tagged and individually tattooed
- mixed into shipping pens
Transport Process

- Loading began at 3am
- Duration of loading 3.5 to 4 hours (PB always loaded first)
- No prod usage
- The duration of transport was two hours
- Both trucks left the farm and travelled together
The trucks waited at the plant ~15 minutes. Then they were unloaded and the pigs were lair aged for 1 hour.
Trailer Temperatures

Average for all compartments at single point in time

*Trucks were different P<0.05
Gonyou et al, unpublished
The effect of the period of transport on mean body temperature of pigs in two trucks

PB always loaded 1st with wait of ~ 1 hour

(Toth-Tamminga et al 2008)
The effect of compartment within the PB during “Stationary”

(Toth-Tamminga et al 2008)

1 = 4 > all other compartments p< 0.02
228 pigs
Duration of Unloading

(Torrey et al 2008) *Trucks were different P<0.01
Duration Unloading

(Torrey et al 2008)

\[ a, b \ P < 0.04 \]

\[ x, y \ P < 0.08 \]
Blood Values

(Correa et al 2008)
## Meat Quality

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<th>Compartment</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<td>42</td>
<td>29</td>
<td>30</td>
<td>24</td>
<td>42</td>
<td>30</td>
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Quality category in the *longissimus dorsi* (%)

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<th>MODERATE PSE</th>
<th>PFN</th>
<th>NORMAL</th>
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<td>0</td>
<td>4</td>
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</tr>
</tbody>
</table>

(Correa et al 2008)
Factors Leading to Variation in Pork Quality

RESEARCHERS:
Peter Purslow
Kees deLange
Ira Mandel
Jim Squires
Andy Robinson
Tina Widowski

GRADUATE STUDENT:
Jennifer Brown
Experience
Walking the Pens

• 0, 1, 2 or 3 times per week beginning ~12 weeks prior to shipping

• Handler entered the pen and while holding a pig board, made one complete circuit around the pen

• Average time in the pen was 39 ± 0.3 seconds

(Brown et al, 2006)
Behaviour in Home Pen

• One day each week, the responses of pigs to the handler entering the pen were recorded

  % of pigs that showed “escape” - pigs rapidly moved away from the handler often piling along the back of the pen

  % of pigs that “approached” - pigs attempted to nose the board, boots or legs of the handler

(Brown et al, 2006)
% Pigs Showing “Escape” As Handler Entered Home Pen

Week of Trial

(P<0.05)

(Brown et al, 2006)
% Pigs “Approaching” As Handler Entered Home Pen

Week of Trial

(P<0.05)

(Brown et al, 2006)
BUT does a difference in fearfulness of people in the home pen translate into better handling when pigs are shipped?
Behaviour at the Abbatoir
Behaviour Measures At Plant

- Time in the pen (seconds)

- Pig behaviour in pen (frequency)
  Avoidance, falling, jamming

- Human intervention (frequency)
  Pushes, slaps, prods

(Brown et al, 2006)
Effect of walking pens on frequency of jamming in the crowd pen

Data from Farm 1

Means are different P<.05

(Brown et al, 2006)
Effect of walking pens on time in the crowd pen (seconds)

Data from Farm 2

Brown et al, 2006

a, b Means are different P<.05
Individual Differences in Pig’s Behaviour
Behaviour Tests
24 pigs tested on each of 26 Commercial Farms

To determine whether behaviour at the farm predicts behaviour, stress, meat quality at the plant

**Standardized tests:**
- Human approach test
  Time to approach and contact person

- Novel object test
  Time to approach and contact object

- Open door test
  Time to voluntarily exit pen

(Brown et al, 2008)
Open Door Test

Pen door is opened and the time for individual pigs to leave the pen is recorded

- exit < 60 sec = ‘Bold’
- exit 61-180 sec = ‘Intermediate’
- remain after 180 sec = ‘Shy’

(Brown et al, 2008)
Individual Identification

Combination of coloured ear tags, spray paint markings, unique slap tattoo

**Allows Tracking**

- Farm
- Handling at Plant
- Blood Collection
- Meat & Tissue Samples
Effect of Temperament on Handling at the Abbatoir – Data from 26 farms

Shy pigs had paler loin muscle than Bold pigs $L^*=45.9$ vs 45.2 $P<0.05$

(Brown, unpublished data)
Effect of Temperament and Handling
Handling at the Abbatoir

- Two commercial farms
  - Prior trials - one had good, the other had poor meat quality measures
- 36 pens/farm with ~ 20-25 pigs/pen
- Pens randomly assigned to 3 treatments for the 8 weeks prior to shipping
  - Control
  - Walking Pens
  - Crowd
Handling Treatments

• Pen walk
  – 2 x per week a handler walks through pen encouraging pigs to move away (~ 50 sec )

• Crowd treatment
  – 2x per week a handler drives pigs through narrow passage (~2 min)
Methods

- At end of 8 weeks ~27 pigs/treatment (80/farm) selected and marked for meat quality analysis
- For each farm pigs from each treatment were slaughtered on 3 separate days
- Before shipping, ‘Open Door Test’ was used to identify ‘bold’ and ‘shy’ pigs (temperament) within each treatment group
Meat Quality Measures

- For both the loin and ham
  - Colour - lightness (L*) where higher score means paler pork
  - % Drip Loss
  - Final pH - lower value means more lactic acid which can lead to PSE pork
Effect of Temperament on Handling at the Abbatoir

(Brown et al, 2008)

(P<.05)
Effect of Handling Treatment on Ham Drip Loss

Pigs in the “Crowd” treatment were more difficult to handle

(Brown et al, 2008) (P<.05)
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