Effects of journey time to slaughter on the welfare of pigs

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COUNCIL REGULATION (EC) No 1/2005

of 22 December 2004
on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC and Regulation (EC) No 1255/97
Journey times for pigs

• EC 1\2005 prescribes a maximum journey duration for pigs of 8 hours on standard vehicles

• For higher standard vehicles the maximum journey time is 24 hours

• The effects of differing journey times upon pig welfare should be the basis of improved definition of maximum journey duration
Journey times for pigs

• Study in two phases:-

  - Survey of pig journeys to slaughter
    • From a haulier perspective
    • From a slaughterhouse perspective

  - Examination of the effects of journey length on indices of stress and welfare at a single slaughter house - journey characteristics, conditions and behaviour and meat quality measures
Journey types data bases

- Data base – haulier perspective
- Data base – Slaughterhouse perspective
- Data cover a 12 month period (same)
  - Analysis of Haulier diaries and records
    - calculation
  - Analysis of AMLs and eAMLS
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of journeys</td>
<td>3305</td>
</tr>
<tr>
<td>Total number of fat pig journeys</td>
<td>1984</td>
</tr>
<tr>
<td>% Fat pig journeys</td>
<td>60</td>
</tr>
<tr>
<td>% journeys 0-2 hours (no)</td>
<td>40 (793)</td>
</tr>
<tr>
<td>% journeys 2-4 hours</td>
<td>34 (680)</td>
</tr>
<tr>
<td>% over 4 hours</td>
<td>26 (514)</td>
</tr>
<tr>
<td>% over 8 hours</td>
<td>0.8 (16)</td>
</tr>
</tbody>
</table>
### Slaughterhouse perspective

- **Total number of journeys**: 7105
- **% journeys 0-2 hours (no)**: 14 (990)
- **% journeys 2-4 hours (no)**: 45 (3210)
- **% journeys 4-6 hours (no)**: 28 (1985)
- **% journeys 6-8 hours (no)**: 9.5 (677)
- **% over 8 hours (no)**: 3 (243)
- **% multi pick-up (no)**: 24* (1709)
  - 22*
Comparison: haulier - slaughterhouse

<table>
<thead>
<tr>
<th></th>
<th>Haulier</th>
<th>Slaughterhouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total journeys (fat pigs)</td>
<td>1984</td>
<td>7105</td>
</tr>
<tr>
<td>% journeys 0-2 hours (no)</td>
<td>40 (793)</td>
<td>14 (990)</td>
</tr>
<tr>
<td>% journeys 2-4 hours (no)</td>
<td>34 (680)</td>
<td>45 (3210)</td>
</tr>
<tr>
<td>% journeys 4-6 hours (no)</td>
<td>13 (262)</td>
<td>28 (1985)</td>
</tr>
<tr>
<td>% journeys 6-8 hours (no)</td>
<td>12 (236)</td>
<td>9.5 (677)</td>
</tr>
<tr>
<td>% journeys &gt; 8 hours (no)</td>
<td>1 (16)</td>
<td>3.5 (243)</td>
</tr>
</tbody>
</table>

Wheels turning
Summary of data bases

• Comparison of journey times for haulier and slaughterhouse perspectives:-

- The majority of slaughter journeys are **under 6 hours** duration (87% haulier : 87% slaughterhouse)

- The commonest duration category was **0-2 hours** (haulier – wheels turning) and **2-4 hours** (slaughterhouse)

- 74% (haulier) and 69% (slaughterhouse) of journeys were **under 4 hours**

- Only 1% (haulier) and 3.5% (slaughterhouse) of journeys were **over 8 hours** duration
Single slaughterhouse study
Single slaughterhouse study

• Data collection

• On Arrival
  - Vehicle and journey information
  - Lameness scores
  - Injuries
  - General health / appearance
  - Lorry / pig weights (carcase weights)

• Behaviour
  - 1 hour
  - 51 pigs
Single slaughterhouse study

• Data collection
• On Arrival
  - Vehicle and journey information
  - Lameness scores
  - Injuries
  - General health / appearance
  - Lorry / pig weights (carcase weights)

• Behaviour
  - 1 hour
  - 51 pigs
Behavioural measures

• Continuous behaviours
  
  - first and second pig starts drinking
  
  - first and second pig lies down
  
  - Record fighting throughout the observation period
Behavioural measures

• Instantaneous sampling

  - Behaviour scans are made every five minutes, starting 5 minutes after the last pig enters the pen up to 60 minutes after penning. This means there will be 12 scan intervals starting at 5 minutes and ending at 60 minutes.

• Drinking
• Standing
• Sitting
• Lying down
• Fighting
Meat Quality (stress?) Measures

• Kill at 1 hour – pigs on line
• First 20 pigs of each batch of 51in chiller and labelled
• $pH_i$ – 2 muscles (+ meat temp)
• $Colour_{45}$ (L, a, b – Minolta colour meter)
• $pH_{24}$ and $Colour_{24}$ (+ meat temp)
• Calculate Hue and Chroma

Semimembranosus and longissimus lumborum
Single slaughterhouse study
Single slaughterhouse study
Single slaughterhouse study
Single slaughterhouse study

Data were analysed by:-

GLMM (logit link function)

Logistic regression models

REML
Single slaughterhouse study

Total 84 journeys – November - August
### Sampled journeys

<table>
<thead>
<tr>
<th></th>
<th>Experimental trial / study journeys</th>
<th>SH data base</th>
</tr>
</thead>
<tbody>
<tr>
<td>% journeys 0-2 hours (no)</td>
<td>23 (19)</td>
<td>14 (990)</td>
</tr>
<tr>
<td>% journeys 2-4 hours (no)</td>
<td>45 (38)</td>
<td>45 (3210)</td>
</tr>
<tr>
<td>% journeys 4-6 hours (no)</td>
<td>23 (19)</td>
<td>28 (1985)</td>
</tr>
<tr>
<td>% journeys 6-8 hours (no)</td>
<td>5 (4)</td>
<td>9.5 (677)</td>
</tr>
<tr>
<td>% journeys &gt; 8 hours (no)</td>
<td>5 (4)</td>
<td>3.5 (243)</td>
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</table>
Injury

Incidence of injury in relation to journey length categories

![Graph showing mean total injury across different journey lengths (0-2hrs, 2-4hrs, 4-6hrs, 6-8hrs, 8+hrs). The y-axis represents mean total injury, ranging from 0 to 14, and the x-axis represents journey length in hours.]
Drinking Behaviour

Total drinking behaviour post transport

Mean total occurrence

Journey length category

0-2hrs  2-4hrs  4-6hrs  6-8hrs  8+hrs
Total resting behaviour post transport

Mean total occurrence

Journey length category

- 0-2hrs
- 2-4hrs
- 4-6hrs
- 6-8hrs
- 8+hrs

Mean total occurrence
Meat Quality Measures

Muscle pH results at 45 minutes post slaughter categorised by journey length time bins

<table>
<thead>
<tr>
<th>Journey length category</th>
<th>Mean pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2hrs</td>
<td>Leg45</td>
</tr>
<tr>
<td>2-4hrs</td>
<td>Back45</td>
</tr>
<tr>
<td>4-6hrs</td>
<td></td>
</tr>
<tr>
<td>6-8hrs</td>
<td></td>
</tr>
<tr>
<td>8+hrs</td>
<td></td>
</tr>
</tbody>
</table>

- Leg45
- Back45
### Muscle pH Results at 24 Hours Post Slaughter Categorised by Journey Length Time Bins

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<th>Journey Length Category</th>
<th>Mean pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2hrs</td>
<td>5.5</td>
</tr>
<tr>
<td>2-4hrs</td>
<td>5.5</td>
</tr>
<tr>
<td>4-6hrs</td>
<td>5.5</td>
</tr>
<tr>
<td>6-8hrs</td>
<td>5.5</td>
</tr>
<tr>
<td>8+hrs</td>
<td>5.6</td>
</tr>
</tbody>
</table>

The bar chart shows the mean pH values for different journey length categories, with error bars indicating the variability. The categories are 0-2hrs, 2-4hrs, 4-6hrs, 6-8hrs, and 8+hrs, and the mean pH values are 5.5 for each category, with a slight increase to 5.6 in the 8+hrs category.
Other factors examined

- Farm type \ production system
- Abattoir Standing Time (AST)
- Mean, max and min temperatures on days of travel
### Production systems for delivered pigs

<table>
<thead>
<tr>
<th>Environment</th>
<th>Number of loads monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>2</td>
</tr>
<tr>
<td>Slatted/solid floor</td>
<td>49</td>
</tr>
<tr>
<td>Straw based (yards, pens, courts)</td>
<td>26</td>
</tr>
<tr>
<td>organics/outdoor</td>
<td>7</td>
</tr>
</tbody>
</table>
Lameness recorded post transport

Lameness

![Graph showing lameness recorded post transport in different home farm environments]

- Slatted or solid floor
- Straw based
- FFO/Outdoor

Home farm environment

Mean % of load

Mean % of load
Wounds

Relationship between home farm environment and incidence of wounds on arrival at slaughterhouse

Mean total

Slatted | Straw based | FFO/Outdoor
Home farm system

Relationship between home farm environment and latency to rest

![Bar chart showing mean latency (s) for different environments: indoor slatted or solid floor, indoor straw based, and outdoor or organic. The outdoor or organic environment has the highest mean latency, followed by the indoor slatted or solid floor and indoor straw based environments.]
Standing time – Drinking behaviour

Relationship between AST and total drinking

Mean total occurrence

0-1hour  | 1-2hours  | 2-3hours

0  | 10  | 20

0  | 30  | 50

0  | 40  | 60

0  | 50  | 70
Standing time – Resting Behaviour

Relationship between AST and total resting

Mean total occurrence

0-1hour | 1-2hours | 2-3hours

0 100 150 200 250 300 350
Meat Quality Measures

Effect of home farm environment on subsequent muscle pH 24 hours post slaughter

![Bar chart showing the mean pH of meat from different environments and areas. The chart includes data from slatted or solid floors, straw-based environments, and outdoor conditions.]
Meat Quality Measures

Effect of abattoir standing time on subsequent muscle pH 45 minutes post slaughter

<table>
<thead>
<tr>
<th>Time</th>
<th>Leg45</th>
<th>Back45</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1hr</td>
<td>6.15</td>
<td>6.2</td>
</tr>
<tr>
<td>1-2hrs</td>
<td>6.1</td>
<td>6.2</td>
</tr>
<tr>
<td>2-3hrs</td>
<td>6.15</td>
<td>6.25</td>
</tr>
</tbody>
</table>

Mean pH

Graph showing the effect of abattoir standing time on subsequent muscle pH 45 minutes post slaughter.
Thermal conditions

Relationship between environmental temperature and total resting behaviour post transport

$R^2 = 0.4776$
Thermal conditions

Relationship between environmental temperature and latency to rest post transport

\[ R^2 = 0.2598 \]
## Correlation matrix

|       | JLL | TRest | Lat Rest | Lame % | pH45L | pH45B | pH24L | pH24B | Li45L | Li45B | Li24L | Li24B | C45L | C45B | C24L | C24B | H45L | H45B | H24L | H24B |
|-------|-----|-------|----------|--------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|
| JLL   |     |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| TRest |     |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| Lat Rest | 0.331 |     |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| Lame% |      | -0.676 |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| pH45L |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| pH45B |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| pH24L |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| pH24B |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| Li45L |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| Li45B |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| Li24L |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| Li24B |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| C45L  |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| C45B  |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| C24L  |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| C24B  |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| H45L  |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| H45B  |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| H24L  |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |
| H24B  |      |       |          |        |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |

*P < 0.001  P < 0.01  P < 0.05  P < 0.1 (trend or tendency)
Summary

• There were no significant correlations/relationships to support the hypothesis that commercial journey time would affect the measures of stress/welfare in the sampled journeys

• Several other factors may affect post-journey behaviour and meat quality
Summary

- These include:
  - Production system
  - Abattoir standing time
  - Temperature

- Clearly the effects of these factors (and their combinations) will be exacerbated by extended journey time

- Journey time per se (in the range studied) does not appear to constitute a major threat to welfare or product quality (measured indices – proxy?)
• The assumption that journey time may be studied under “commercial conditions” to detect direct effects upon welfare and production efficiency is confounded by the multiplicity of other factors impinging upon the relevant measures.
In summary

• There were no statistically significant indications that journey time had a detrimental effect of the pigs transported under commercial conditions in this study
  - when all the current regulations and recommendations for practice were adhered to.
Thank you for your attention!
The problem of “journey times”

- The legal journey time is first animal loaded until last animal unloaded
- This includes all stops, delays and hold
- All of these may affect ventilation and internal conditions
- Periods of acceleration and motion may differ in “same journey time”
- Inaccuracies in recording (AML) may lead to erroneous estimates of journey time (e.g. multiple pick-ups)
- Constraints on “access” and type – representitive?
- Relating journey time alone to outcomes is difficult in small and uncontrolled samples
Legal journey times?

- Legal start
- Legal finish
- Journey time
- Standing time
- Recorded start
- Pick-up time
- Journey time
- Standing time
- Pick-up
- Journey time
- Standing