Improved animal welfare, the right technology and increased business

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- Meat Technology
- Food Safety
- Measurement Systems & IT
- Slaughterhouse Technologies
- Automation
- Business Development
From farm to slaughter

Why animal welfare?

Pre-slaughter handling
  Pigs
    - The group-based principle
    - Transport, Lairage, Stunning
  Poultry
    - Collection, Transport, Stunning

Surveillance and documentation of animal welfare
  Pigs
  Poultry

Improved value of the livestock
Why animal welfare?

- Ethical responsibility
- Demands from the market and authorities
- Improvement of value/less loss due to injuries

**Points of action**
- Documentation of animal welfare
- Optimization of handling on the day of slaughter
  - Transport and delivery to the slaughterhouse
  - Lairage
  - Stunning and sticking
Regulations


General requirements

- Animals shall be spared any avoidable pain, distress or suffering during killing and related operations
- Business operators shall take the necessary measures to ensure compliance with the obligation mentioned above
- Facilities used for killing and related operations shall be designed, constructed, maintained and operated so as to ensure compliance with the obligations mentioned above
A good animal welfare standard is good business
Pre-slaughter handling - Pigs

- Loading
- Transport
- Break, loading
- Delivery, unloading
- Lairage
- Driving
- Sticking
- Stunning

Pre-slaughter handling refers to the process of preparing pigs for slaughter, including loading, transport, break, loading, delivery, unloading, lairage, driving, sticking, and stunning.
From farm to slaughterhouse

- Pigs in smaller groups (15)
- Groups only mixed once when loaded on the transport vehicle
- Uniform delivery at the abattoir
- Little mixing of pigs
- Low incidence of fighting

Transport/lairage

<table>
<thead>
<tr>
<th>Skin damage</th>
<th>Group size 15</th>
<th>Group size 45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legs</td>
<td>3.9%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Shoulder</td>
<td>16.1%</td>
<td>23.7%</td>
</tr>
</tbody>
</table>

Gade & Christensen, 1999

Uses the instinct of the animals
Considerate treatment
Improves meat quality
Group-based principle

The handling of pigs at the Danish slaughterhouses are optimized with respect for the animal

DMRI

Pre-slaughter handling Pigs
Animals must be suited for the intended transport.

Factors of importance

- Journey duration
- Climate - ambient temperature, CO₂-concentration, humidity
- Animal location in the vehicle
- Stocking density
- Vehicle design
- Floor type and bedding
- Driving style
- Mixing with unfamiliar pigs
Mortality during transportation and lairaging
Slaughter pigs

Mortality o/oo

Year

Transport slaughter pigs
Lairage slaughter pigs
Total slaughter pigs

Pre-slaughter handling Pigs
Lairage

Lairage time to optimize production or as short as possible

Aggressions increase after three hours

= 

Pre-slaughter handling Pigs
CO₂ stunning

- Allows the group-based principle
- Avoid restraining of pigs
- Improve meat quality (fewer haemorrhages, lower drip loss)
- Signs of aversion to the gas a few seconds before unconsciousness occurs

Stunning procedure
- CO₂ concentration
- Stunning time
- Stun to stick interval

Stunning quality
- No conscious movements
- No respiration
- Cornea reflex
- No vocalisation
Driving and stunning

% Drip loss

Traditional  Group

Pre-slaughter handling Pigs
Box position: 7 = entrance, 6 = first stop after entrance…….1 = tip out

Pre-slaughter handling
Pigs
Muscular haemorrhages in pork

- A haemorrhage indicates that there has been a strain on the pig
- A haemorrhage causes trimming
- The most common types of haemorrhages observed in pork:
  - Blood spots in tenderloin tip or head
  - Point haemorrhages in ham muscles
- Most haemorrhages occur during the last two hours before sticking
- Best practice for driving and stunning minimize the incidence of haemorrhages

Pre-slaughter handling Pigs
Slaughter process – critical points

- Collection
- Transport conditions
- Shackling
  - Risk of induce or increase pain/ shackling of live birds cause them to struggle, flap their wings and vocalise
  - Condition and size of shackles
  - Suspended birds should not hang conscious for more than one minute
- Stunning methods
- Head cutting/debleeding
  - Correct manual or automatic cutting of neck veins
  - Automatic cutting has to be followed by inspection

Technology combined with management can improve animal welfare and quality
From farm to slaughter

Transportation

- Climate
  - Ventilation
  - CO$_2$-concentration
  - Temperature
  - Humidity
- Duration
- Boxes - design, number of birds
- Delivery to slaughterhouse
Stunning methods

- Commonly used stunning methods at commercial chicken slaughterhouses
  - Electrical stunning in water bath
  - Controlled Atmosphere Stunning (CAS)
- Other methods
  - Head only Stunning System™
  - Low atmospheric pressure stunning (LAPS)
- Loss of consciousness before killing
Electrical stunning in water bath

System
- Head to body electrical stunning

Comments
- Shackling of living birds
- Actual current received by each bird depends on its resistance that varies
- Electro-immobilization instead of loss of consciousness
- Risk of pre-stun shock
Controlled Atmosphere Stunning (CAS)

System
- CO$_2$ - multiphase systems using O$_2$ and CO$_2$. 1$^{st}$ phase, low concentrations of CO$_2$ (max. 40 %) are induced to reduce aversiveness, 2$^{nd}$ phase, CO$_2$ concentrations are increased (80 %)

Comments
- Less damage (bone fractures, bruises and haemorrhages) compared with electrical stunning (Gigaud et al., 2010)
- Withdrawal reaction -> more damages
- Admixture of oxygene -> less damages
- Possible to stun in transport modules
- Sorting out ‘dead’ bodies – thermography?
Stunning quality

Behaviour indicators
- No rhythmic respiration
- No cornea reflex
- No wing flapping/no conscious movements
- No vocalisation

Key parameters to be controlled
Electrical stunning
- Minimum current, voltage
- Maximum frequency
- Minimum time of exposure
Gas stunning
- CO₂ concentration
- Duration
- Gas quality
- Gas temperature
Stun-to-stick/kill interval
## Stunning – welfare advantages and challenges

<table>
<thead>
<tr>
<th></th>
<th>Electrical stunning</th>
<th>Controlled Atmosphere Stunning</th>
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</thead>
<tbody>
<tr>
<td><strong>Industrial use</strong></td>
<td>80 %</td>
<td>20 %</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>Rapid onset of unconsciousness</td>
<td>Stunning in transport modules</td>
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<tr>
<td></td>
<td>Limited operation cost</td>
<td>Shackling post-stun</td>
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<td></td>
<td></td>
<td>Fewer haemorrhages</td>
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<tr>
<td><strong>Challenges</strong></td>
<td>Shackling</td>
<td>Operation cost</td>
</tr>
<tr>
<td></td>
<td>Potential for prestun shock</td>
<td>Unconsciousness is not rapid</td>
</tr>
<tr>
<td></td>
<td>Electro-immobilization vs. unconscious</td>
<td>Detection of bodies that died during transport</td>
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<td></td>
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<td>Consciousness at loss of posture</td>
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Ref. Buhr (2009)

Pre-slaughter handling
Poultry
**Surveillance of animal welfare**

**Why?**
- Internal inspection and product responsibility
- Feedback to staff, haulier, farmer etc.
- Demands from market and authorities

**How?**
- Behavioural studies
- Ethical audits
- Continuous monitoring of animal welfare - possibilities:
  - Video recording/Vision systems
  - Sound recording - vocalization by the animals
  - Temperature measurements
  - Blood analysis
  - Etc.
Surveillance of animal welfare

Behavior/clinical measures

Indirect measures

- Simple
- Meaningful
- Valid
- (Cheap)
Movement analysis can give information about the health and welfare of farm animals.

Motion of animals is estimated using optical flow (OF).

A modified angular histogram (MAH) is used to summarize the length of the vectors within a small range of angles.
Skin damage

0  None or a little superficial damage
1  Some superficial damage
2  Clear deep and/or long damage
3  Much deep damage
Automated blood analyses of lactate and creatine kinase (CK)


Surveillance of animal welfare
Pigs
VisStick – monitoring the sticking procedure

Detection range: 98 to 100 %
False positive: 0 to 0.064 %
(Borggaard et al, 2011)
Footpad dermatitis – an indicator of welfare problems

- Danish broilers have been checked for footpad dermatitis since 2002

- Inspected Danish flocks with a low score:

  2003: 30%
  2013: 75%

(Danish Veterinary and Food Administration)
Footpad lesions – automatic measurement
Improved value of slaughter pigs at commercial slaughterhouses

Improvement of pre-slaughter handling incl. optimization of the stunning systems – change from electrical to CO₂ stunning.

⇒ Less PSE
⇒ Lower drip loss
⇒ Fewer haemorrhages
⇒ Increased value of the cuts and more products acceptable for high price markets.

~ $ 4,600,000 for a slaughterhouse killing 4,000,000 pigs a year
Improved value of broilers

Demand for high-quality paws
Chicken paw prices have escalated in the US
Paws accounting for approx. $280 million a year

US Poultry & Egg Export Council, 2009
A very big thank you to my great colleagues at DMRI Margit D. Aaslyng, Helle Daugaard Larsen, Leif Lykke, Lars O. Blaabjerg

www.animalwelfare.dk
Thank you for your attention!

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