Assessment of natural vs mechanical farm ventilation using daily registered data in fattening pigs

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Introduction

- Intensive pig farming
  - Driven by production goals
    - Challenges?
Introduction

- Respiratory diseases
  - A multifactorial problem!

Respiratory Diseases

Environment
- Temperature
- Humidity
- CO₂, NH₄

Management / Housing
- Facilities (e.g. heating, ventilation)
- Genetics
- Biosecurity
- Nutrition
Introduction

▪ Study focus
Study aim

- To assess the effects of ventilation type (mechanical vs natural) on
  - Respiratory disease: Use of daily recorded data!
  - Welfare: Use of a welfare assessment score!
Study set up

- Use of a farrow-to-finish commercial farm in West Flanders, Belgium

- 3 successive production batches (from 08/2015 to 12/2016)
Measuring data

- Environmental data

- Respiratory health data

- Welfare data
Farm

- Comparing 2 fattening units:
  - Each unit: +/- 440 pigs
  - Each pen: +/- 15 pigs
  - IDENTICAL: Genetics, biosecurity, nutrition, heating and floor type, vaccinations, anthelminthic treatments, stocking density, health management ...
Farm

- **Unit 1**
  - **mechanical ventilation**
    - **Air inlet:**
      - valves on both side-walls of the building
    - **Air outlet:**
      - Ventilators on the front and the back side of the building

- **Unit 2**
  - **natural ventilation**
    - **Air inlet:**
      - valves on both side-walls of the building
    - **Air outlet:**
      - Passive ceiling ventilation
        - *via* ridge (roof)
Results

- Environmental conditions (indoor climate)
## Results

- **Environmental conditions (indoor climate)**

  Median difference of **3.9 °C, 239 ppm CO2 and 4 ppm NH3** (p<0.001)

<table>
<thead>
<tr>
<th></th>
<th>Temperature °C</th>
<th>CO₂ (ppm)</th>
<th>NH₃ (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical ventilation</td>
<td>23.3</td>
<td>1254</td>
<td>10</td>
</tr>
<tr>
<td>Natural ventilation</td>
<td>26.9</td>
<td>1683</td>
<td>14</td>
</tr>
</tbody>
</table>
Results

- Respiratory disease
  - A median difference of 2 cases, P<0.001

<table>
<thead>
<tr>
<th></th>
<th>Mechanical ventilation</th>
<th>Natural ventilation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>1 case</td>
<td>5 cases</td>
</tr>
</tbody>
</table>
Results

- Respiratory disease
  - zero-altered neg. binomial regression

<table>
<thead>
<tr>
<th>Natural ventilation</th>
<th>Odds ratio</th>
<th>(95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count model</td>
<td>1.51</td>
<td>(1.35-1.68)</td>
</tr>
<tr>
<td>Zero-hurdle model</td>
<td>4.15</td>
<td>(2.89-5.96)</td>
</tr>
</tbody>
</table>

Ref. : when compared with mechanical ventilation accounted also for batch, season and age

Frequency plot of point prevalence of respiratory disease

Observed daily point prevalence during the last 3 batches
Results

- Welfare assessments

<table>
<thead>
<tr>
<th>Ventilation</th>
<th>first assessment</th>
<th>last assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Mechanical</td>
<td>5.33</td>
<td>5.00</td>
</tr>
<tr>
<td>Natural</td>
<td>10.67</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Best welfare score is zero and the worst score is 28.

1st welfare assessment:
2-3 weeks after start of fattening period

2nd assessment: 3-4 weeks before end of fattening period
Conclusions

- Mechanical ventilation is linked with
  - favorable environmental conditions
  - lower prevalence of respiratory disease
  - better welfare conditions
Thank you for your attention!

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