Effect of weaning conditions on immune parameters of piglets

Arnaud BUCHET\textsuperscript{abc}, Catherine BELLOC\textsuperscript{c}, Elodie MERLOT\textsuperscript{a}

\textsuperscript{a} UMR PEGASE, Agrocampus Ouest, INRA, 35590 Saint-Gilles, France
\textsuperscript{b} Cooperl Arc Atlantique, 22403 Lamballe, France
\textsuperscript{c} BIOEPAR, INRA, ONIRIS, 44307 Nantes, France
Introduction

Reduction of the use of antibiotics

Animal welfare

Profitability

Weaning in pig production

Identification of biomarkers of the robustness of piglets at weaning
Introduction

Weaning

Maternal Ig

Own Ig

Lymphocytes

Neutrophils

Haptoglobin

Immune protection and inflammation

Can those immune parameters be used as biomarkers of adaptation to weaning?
Introduction

Good biomarkers have to be sensitive to weaning factors

- Effect of Age at weaning: few studies. Early age at weaning leads to either:
  - Decrease of Lymphocytes proliferation (Blecha, 1983)
  - No effect (Kick, 2012)

- Effect of management conditions leading to higher stress for piglets:
  - Stress factors are well known to suppress immune system (Merlot, 2004)

Rare and contradictory literature on the subject

What are the effects of weaning age and management conditions on the evolution of immune parameters?
Material and Methods

- 4 groups of 16 animals
- Weaning at 21 or 28 days of age to dissociate age from weaning
- Deteriorated or Optimal Conditions

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Optimal (OC)</th>
<th>Deteriorated (DC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>4 piglets/pen</td>
<td>8 piglets/pen</td>
</tr>
<tr>
<td>Animals mixing</td>
<td>2 litters/pen</td>
<td>8 litters/pen</td>
</tr>
<tr>
<td></td>
<td>Animals mixing 1 week after weaning</td>
<td>Animals mixing 1 week after weaning</td>
</tr>
<tr>
<td>Room cleanliness</td>
<td>Cleaned + disinfected</td>
<td>Not Cleaned + not disinfected</td>
</tr>
<tr>
<td>Temperature during animals transfer</td>
<td>Directly at 28°C</td>
<td>4h waiting at 20°C</td>
</tr>
<tr>
<td>Transition feed 1\textsuperscript{st} Age/2\textsuperscript{nd} age</td>
<td>On 3 days</td>
<td>Direct</td>
</tr>
</tbody>
</table>

- No antibiotic treatment
- Blood samplings, weighing and clinical observations from 12 to 61 days of age
Reduction of growth rate around weaning

Average Daily Weight Gain

Weaning

Time ***
Cond **
Age at weaning: NS
Time*Cond ***
Time*Age at weaning NS
Cond*Age at weaning NS
More severe reduction of growth rate in deteriorated conditions around weaning

- Time ***
- Cond **
- Time*Cond ***
- Age at weaning NS
- Time*Age at weaning NS
- Cond*Age at weaning NS

No effect of age at weaning

Average Daily Weight Gain

Optimal conditions

Deteriorated conditions

Days to weaning

birth to -10
-9 to -4
-3 to 3
4 to 10
11 to 17

No effect of age at weaning
Higher inflammation at weaning

- Time ***
- Cond NS
- Age at weaning NS
- Time*Cond NS
- Time*Age at weaning NS
- Cond*Age at weaning NS

No effect of management conditions
Neutrophils increased at weaning

- Time ***
- Cond NS
- Age at weaning NS
- Time*Cond ***
- Time*Age at weaning **
- Cond*Age at weaning NS
Greater neutrophil increase at weaning in deteriorated conditions

- No effect of age at weaning

** Neutrophils

- Optimal conditions
- Deteriorated conditions

<table>
<thead>
<tr>
<th>Days to weaning</th>
<th>Optimal Conditions</th>
<th>Deteriorated Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>-9</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>-2</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>5</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>12</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>19</td>
<td>bc</td>
<td>c</td>
</tr>
</tbody>
</table>

- No effect of age at weaning
Lymphocytes increased at weaning

- No interaction with management conditions nor age at weaning
IgG decreased with age

No interaction with management conditions
IgM increased with age

Time ***
Cond NS
Age at weaning ***
Time*Cond **
Time*Age at weaning NS
Cond*Age at weaning NS

Days to weaning

Ig M
IgM increased earlier for DC piglets
More piglets with diarrhea in deteriorated conditions with higher inflammation

![Graph showing the percentage of piglets with diarrhea and haptoglobin levels over time.](image-url)
Lower lymphocytes count for piglets which had diarrhea between 5 and 12 days after weaning

- No effect of diarrhea on neutrophils count

![Graph showing lymphocytes count over days to weaning]

*No effect of diarrhea on neutrophils count*
Lower IgM concentration for piglets which had diarrhea between 5 and 12 days after weaning.

- No effect of diarrhea on IgG concentration.
Conclusion

Weaning + Diarrhea

Maternal Ig (IgG)  
Own Ig (IgM)  
Lymphocytes  
Neutrophils  
Haptoglobin

Immune protection and inflammation
Take home message

There is an opportunity to use those parameters as markers of adaptation to weaning.
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  - Experimental facilities
  - Lab
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