Faecal transplants in neonatal and weaning pigs

CPH-PIG seminar January 27th, 2022

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Background for both studies

Susceptibility to post-weaning diarrhoea (PWD) [Dou et al. 2017]

The gut microbiome during the first week of life

Coprophagia [Sansom and Gleed, 1981]

May affect post-weaning performance [Aviles-Rosa et al. 2019]

Characterisation of Early-Life Fecal Microbiota in Susceptible and Healthy Pigs to Post-Weaning Diarrhoea

Samir Dou1, Pascale Gedorra-Widehem2, Véronique Rome3, Douina Hamoudi4, Lari Rhazi5, Lyès Lakhal6, Thibaut Lancher7, Nages Bahl-Jalber8, Arturo Pino-Quintana9, Alain Guyonvarch10, Isabelle L. E. Huërou-Luron11*, Latifa Abdennebi-Najar12**

The ingestion of sow’s faeces by suckling piglets

BY B. F. SANSOM AND P. T. GLEED

Preliminary Study: Depriving Piglets of Maternal Feces for the First Seven Days Post-Partum Changes Piglet Physiology and Performance before and after Weaning

Edgar O. Aviles-Rosa1, Anoosh Rakshshandeh2 and John J. McGlone3,4*
Intervention material

Healthy 11-day-old donors

↑ Lactobacilli [Xu et al. 2016]

Gastric microbiota transplantation
- GMT

Faecal microbiota transplantation
- FMT

Faecal filtrate transplantation
- FFT
- CON

Bacteria, viruses, metabolites, proteins...

Bacteria, viruses, metabolites, proteins...

GMT, FMT, FFT, CON

Sterile saline

0.45 μm filtration
Study overview

Day 2-29 = Body

Arrival at CPN

In-farm vaginal birth

Sow

Day: 1

Formal transplant

FMT (n=18), FTP

GMT (n=18), COP

Day 2-29 = Body

Microbial modulations

CON = saline

FFT (fecal filtrate transplanted)

FMT (fecal microbiota transplanted)

GMT (gastric microbiota transplanted)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 863329.
Study overview

Day 2-29 = Body weight, feed intake + fecal and clinical scoring

- Collection of blood, tissue & gut content
- Colon content: 16S + ETEC qPCR

Arrival at CPN

In-farm vaginal birth

Sow

Formula

Solid feed

Weaning

Euthanasia

Day: 1

2

3

20

23

24

25

26

27

28

29

Transplantation

FMT (n=18), FFT (n=18), GMT (n=18), CON (n=18)

ETEC challenge (10^6 CFU)

Microbial modulations

1 gram/treatment

CON = saline

FFT (fecal filtrate transplantation)

FMT (fecal microbiota transplantation)

GMT (gastric microbiota transplantation)
Results – growth

Means ± SD, n = 15-16
Results – feed intake

Means ± SD, n = 15-16
Results – post-weaning diarrhoea

Means ± SD, n = 15-16
Results

Organ weights

Small intestinal morphology and histology

Blood parameters
- Hematology
- Biochemistry
- Serum cytokines
- Acute-phase proteins

Brush border enzymes
- Peptidases:
  - Aminopeptidase A
  - Aminopeptidase N
  - Dipeptidyl peptidase IV
- Disaccharidases:
  - Lactase
  - Maltase
  - Sucrase
Conclusion - AVANT

- **FFT reduces diarrhoea on day 28-29 post weaning**
- FMT and GMT = similar to controls

Future results:
- 16S rRNA-amplicon sequencing (day 29)
- ETEC qPCR (day 23-29)
Hypothesis: Early life microbial transplants with maternal donor materials from gestational high parity sows can reduce PWD
Study overview and intervention material

Experimental timeline:

- **Suckling period day 1-27**
  - CON $n = 18$ (9 litters), FFT $n = 20$ (10 litters)

- **Inoculation day 1-6**
  - 1 gram/treatment

- **Euthanasia day 27**
  - CON $n = 6$
  - FFT $n = 7$

- **Weaning period day 28-35**
  - CON $n = 6$, FFT $n = 8$

- **Euthanasia day 35**
  - CON $n = 6$
  - FFT $n = 8$
Preliminary results - growth

<table>
<thead>
<tr>
<th></th>
<th>CON</th>
<th>FFT</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suckling period</td>
<td>2654.9 ± 660.8; n=18</td>
<td>2781.4 ± 696.3; n=18</td>
<td>0.445</td>
</tr>
<tr>
<td>Weaning period</td>
<td>6285.0 ± 1972.26; n=6</td>
<td>7258 ± 1184.16; n=8</td>
<td>0.278</td>
</tr>
<tr>
<td>Whole period</td>
<td>3192.8 ± 1269.0; n=6-18</td>
<td>3192.8 ± 1444.94; n=8-20</td>
<td>0.483</td>
</tr>
</tbody>
</table>
Preliminary results – diarrhoea prevalence

**Diarrhoea prevalence daily**

<table>
<thead>
<tr>
<th>Average prevalence</th>
<th>CON</th>
<th>FFT</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suckling period</td>
<td>6.2±5.8; n=18</td>
<td>1.9±2.7; n=20</td>
<td>P=0.09</td>
</tr>
<tr>
<td>Weaning period</td>
<td>33.3±17.8; n=6</td>
<td>16.1±12.9; n=8</td>
<td>P=0.04*</td>
</tr>
<tr>
<td>Whole period</td>
<td>22.9±19; n=6-18</td>
<td>9.0±11.6; n=8-20</td>
<td>P=0.03*</td>
</tr>
</tbody>
</table>
Results

Organ weights

Small intestinal morphology

Blood parameters
- Hematology
- Biochemistry
- Serum cytokines
- Acute-phase proteins

Brush border enzymes
- Peptidases:
  - Aminopeptidase A
  - Aminopeptidase N
  - Dipeptidyl peptidase IV
- Disaccharidases:
  - Lactase
  - Maltase
  - Sucrase

16S rRNA-amplicon sequencing

This project has received funding from the European Union’s Horizon 2020 Research and Innovation Programme under Grant Agreement No 803829.
Conclusion – Pilot study – FFT on farm

- FFT reduces diarrhoea post-weaning
Thank you for your attention!

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