Effect of a beneficial flora colonization of pen surfaces on health and performance of pig weaners

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70th EAAP Meeting

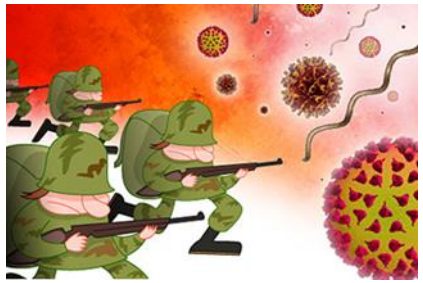
Ghent, Be, 29 Aug – 2 Sept 2016

S.60 Sow + gilt nutrition and management

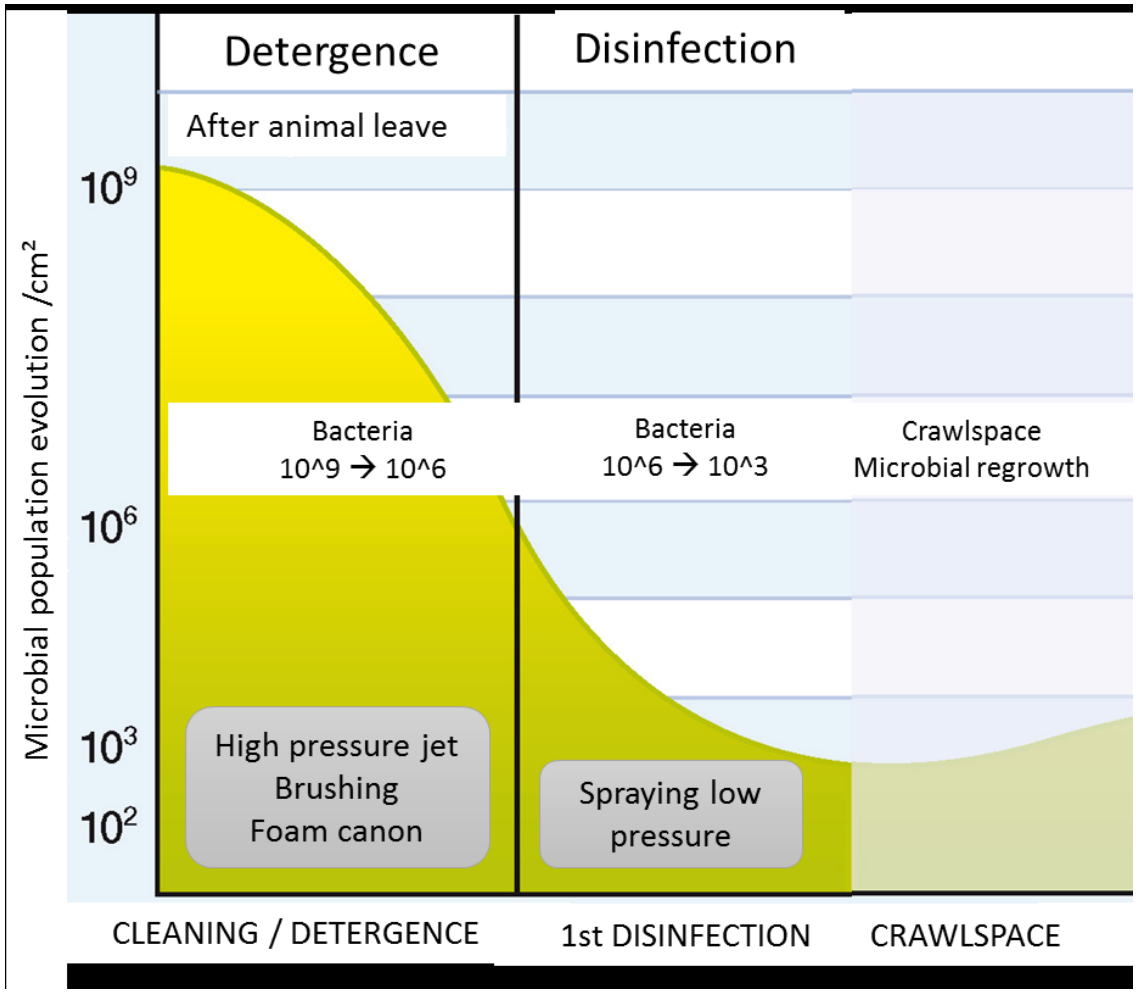
Weaning of piglets

- Weaning challenge
  - Key period involving nutritional, behavioural, immunological stress
  - Poor health, inflammation, disease → weaning diarrhoea

- Prevention measures
  - Disease controls (vaccination,..)
  - Feed, housing improvement
  - Hygiene, cleaning and disinfecting
  - Additives in feed and water
  - Flora control of surface (biofilms) ?
    - Food processing industry (Leriche & Carpentier, 2000; Pérez- Ibarreche et al, 2014, 2016; Giaouris et al, 2015; McLansborough, 2015; Camargo et al, 2018)
    - Weaned piglets (Corrégé et al, 2014)



Microbial population after cleaning-disinfecting process



Aims of the study

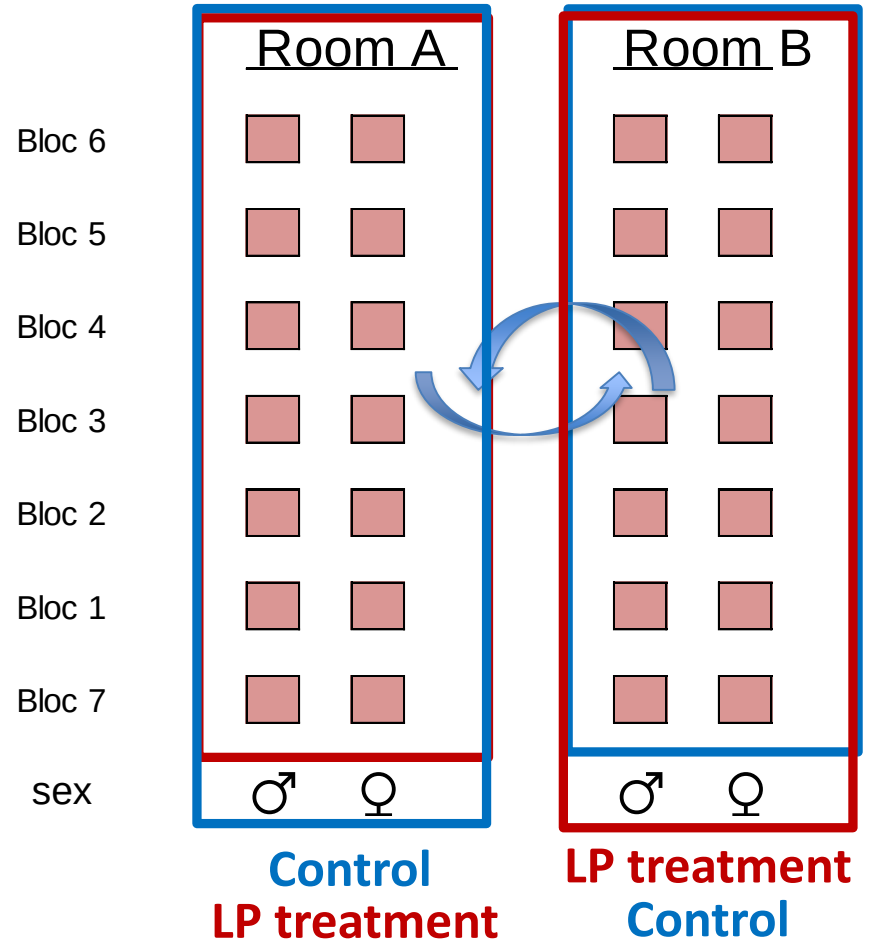
- Secure pen surfaces by implementation of a positive and protective flora
- Decrease risk of health issues due to harmful microorganisms in animal environment

Materials et methods : design

- **Experimental design**
  - 2 trials (270 / 224) × 28 d weaned piglets : 2 treatments

Trial 1

Trial 2



- **Flora product**
  - *Bacillus* spp. + Lactic acid bacteria (Lalfilm Pro, Lallemand)

Materials et methods : health & hygiene

- Challenged weaning
  - diarrhea disease in farrowing and weaning units in 2018
  - sanitary status degradation (Le Floc'h et al, 2004; Gaudré et al, 2007)
    - over- (0.31/0.34 m^2/piglet, Trial 1) or standard- (0.4 m^2/piglet, Trial 2) density in pens
    - slight increase of crude protein for phase 1 diet (18 →19 % CP)
    - partial (Trial 1) or total (Trial 2) emptying of the manure
- Positive flora colonization
  - Cleaning & disinfecting protocol Trial 1 & Trial 2
    - detergent product (non-ionic surfactants, quaternary ammoniums, sodium hydroxide; Lipoclean, Farm'Apro, F)
    - high pressure cleaning
    - disinfecting product (Sanifarm NF, Farm'Apro, F)
  - *Bacillus* spp. + Lactic acid bacteria *vs.* water
    - Spraying = 10 g /100 m^2 deployed surface
      → 2.10^9 cfu/m^2
    - ×2 / Trial 1
    - ×6 / Trial 2

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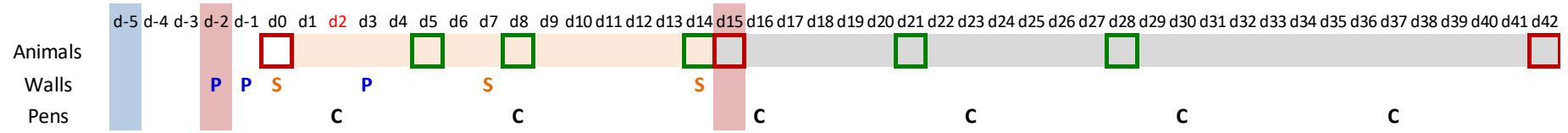
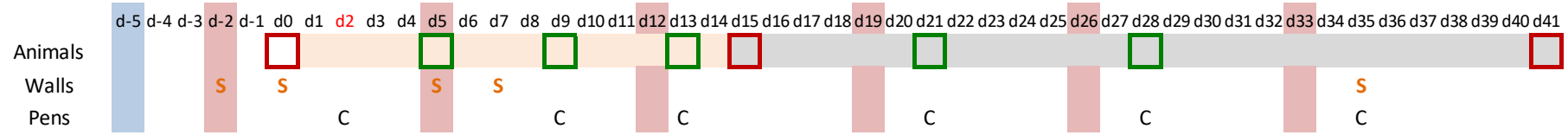
Sampling & measurements

Trial 1



Trial 2



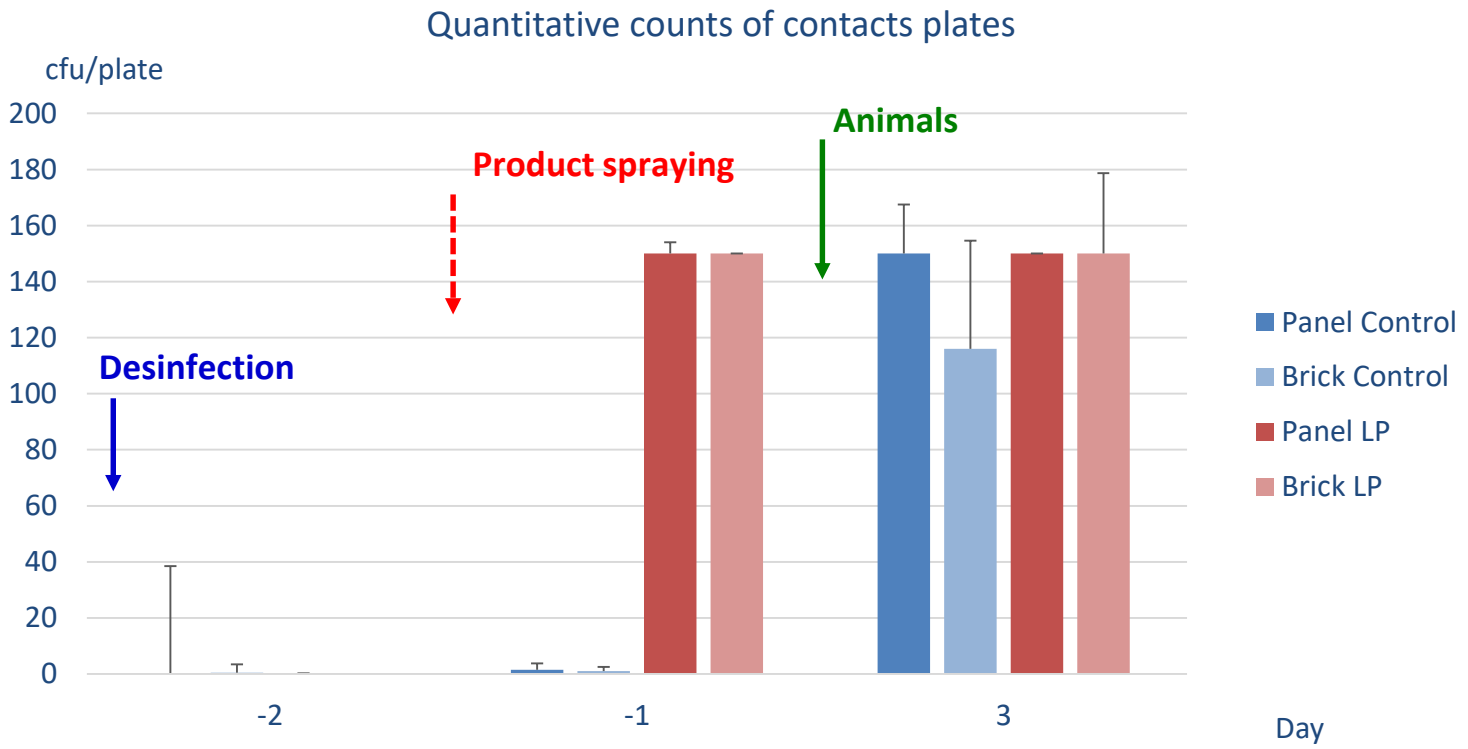
Phase 1 diet
Phase 2 diet

Disinfecting
LP product spraying

- **Performances & health parameters**
  - Animals
    - weighing at d0, 15, 41/42 □
    - faecal scoring ×5 □
  - Surfaces samplings
    - Contact plates ×3 (Trial 1 all pens) **P** Total bacteria
    - Wipes ×3 (Trial 1_ 8p/t) ×5 (Trial 2_4p/t) **S** Enterobacteriaceae, Lactic flora, Coagulase-positive staphylococci, (Trial 1) Intestinal enterococci, spores of aerobic bacteria 30°C, Coliforms 44°C, (Trials 1 &2)
    - Cleanliness scoring of pens ×5 **C**

Results : Evolution of pen surface flora

- Bacteria colonization after disinfection or LP spraying on walls in Trial 1



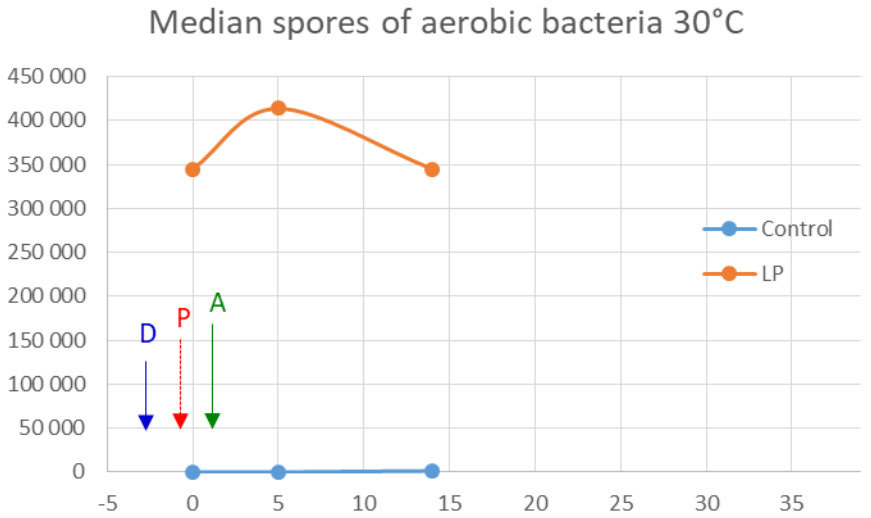
Results are medians in cfu of sampling in 14 pens per treatment for the partitioning panels and of 6 samples on the back brick wall of 2 pens. For calculations, results were reported as equal to 150 for concentrations above the quantification limit i.e 150 cfu.

Evolution of pen surface flora

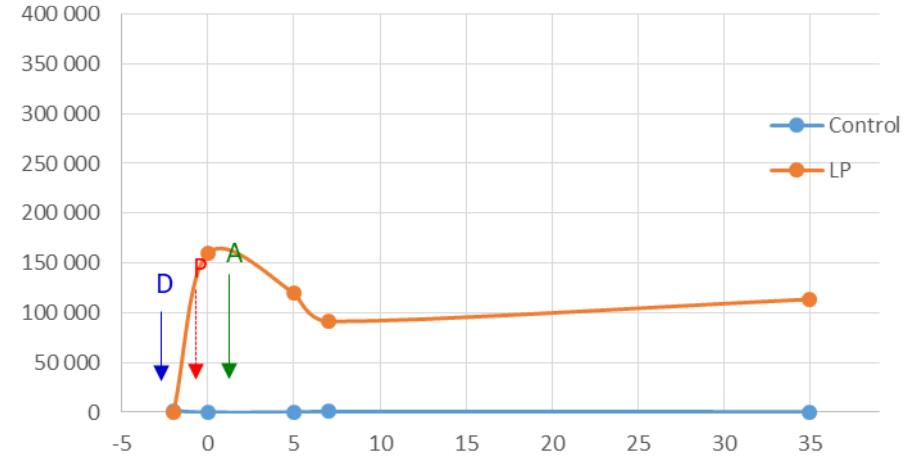
Spores of aerobic bacteria *cfu/m²*

Median

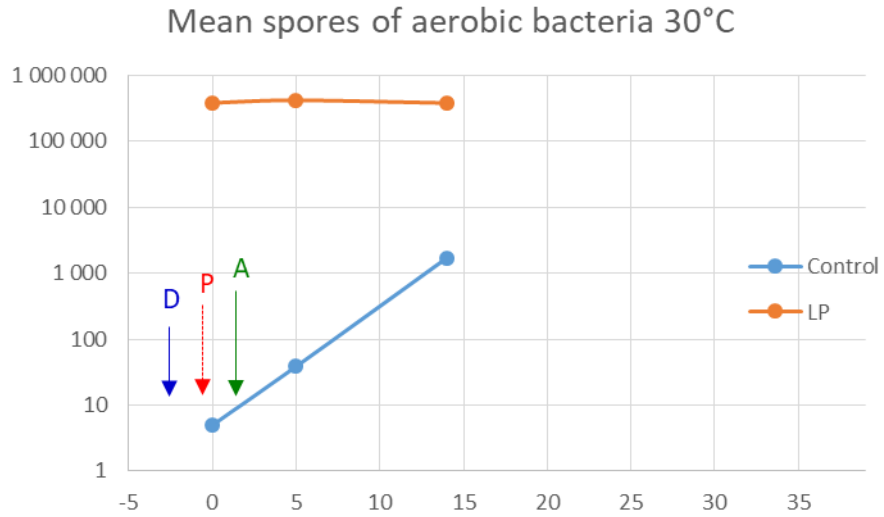
Trial 1

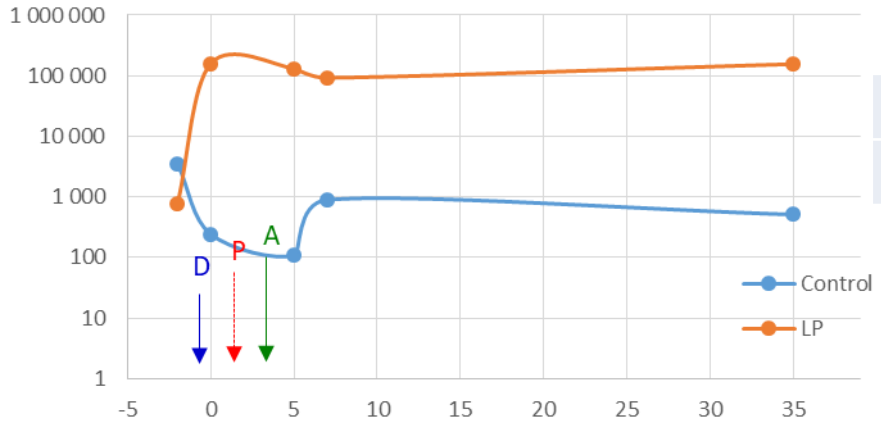


Trial 2



Mean





P-value

Wilcoxon one-side

d 0	d 5	d 14
0,004	0,000	0,007

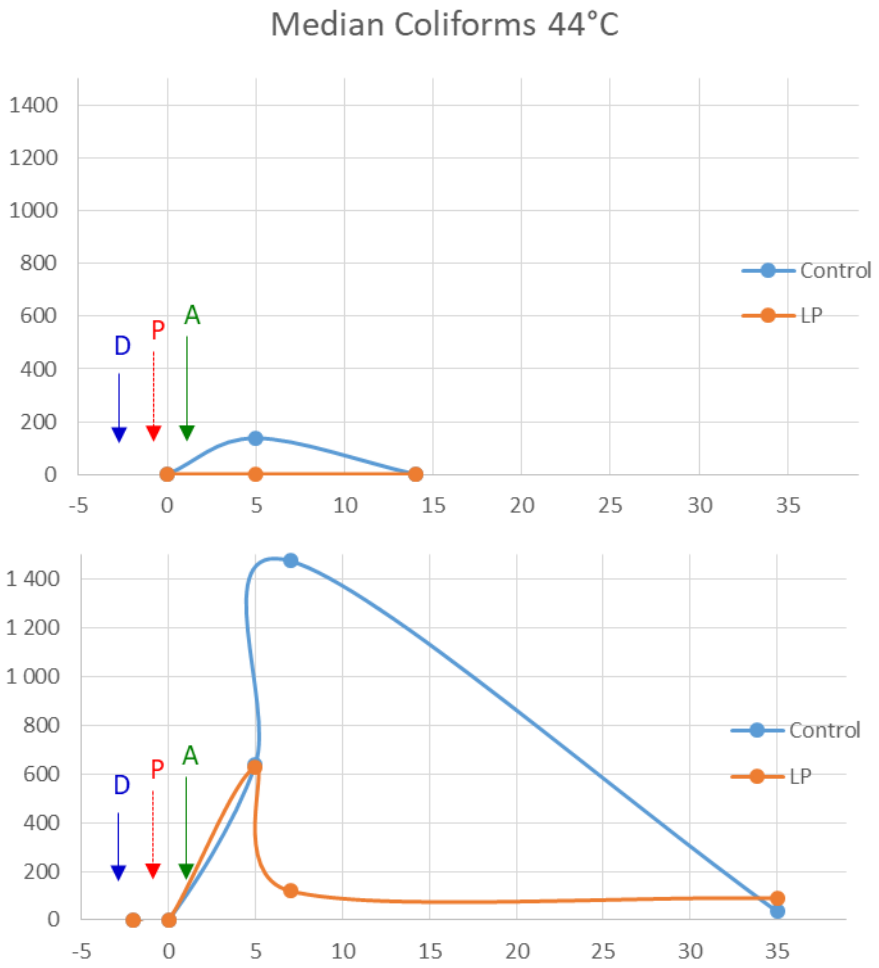
d -2	d 0	d 5	d 7	d 35
0,33	0,024	0,014	0,015	0,015

Evolution of pen surface flora

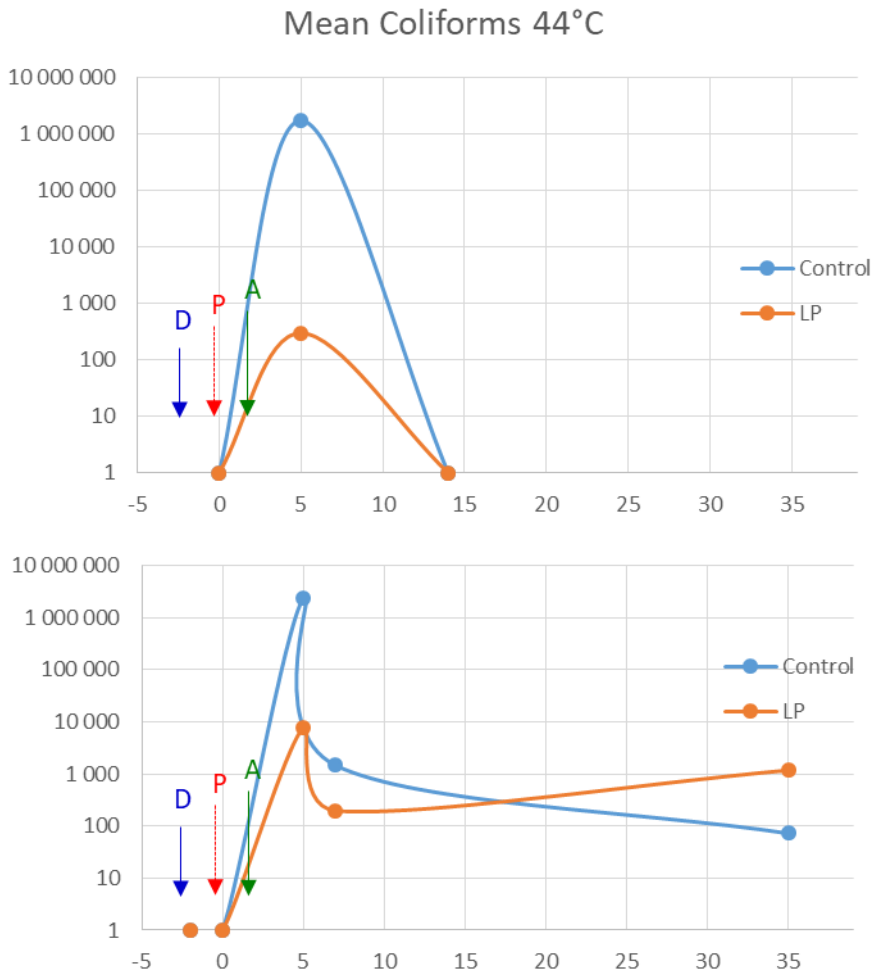
Coliforms 44° C

cfu/m²

Median



Mean



P-value

Wilcoxon one-side

Trial 1

d 0	d 5	d 14
	0,17	

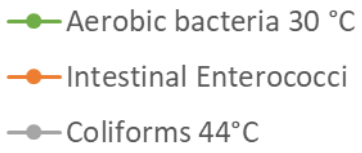
Trial 2

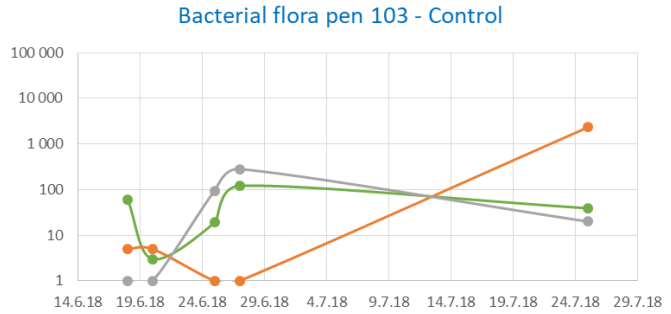
d -2	d 0	d 5	d 7	d 35
		0,50	0,28	0,10

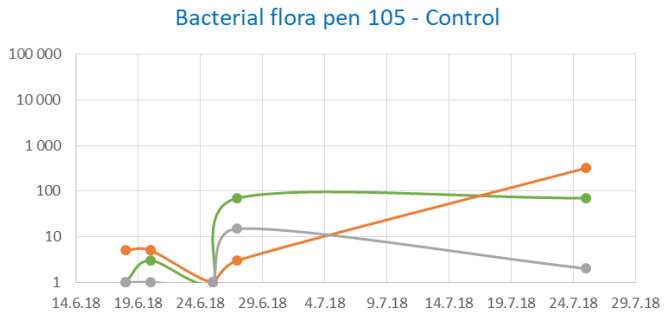
Evolution of pen surface flora in Trial 2

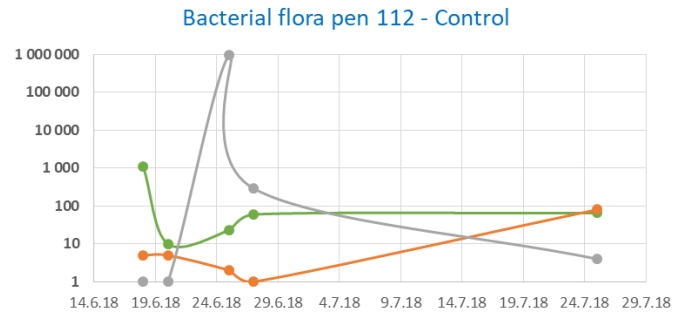
Control

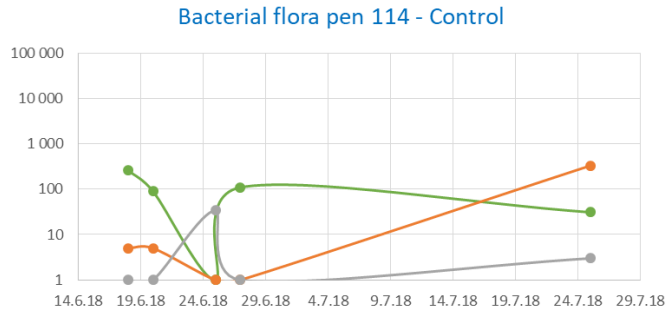
LP

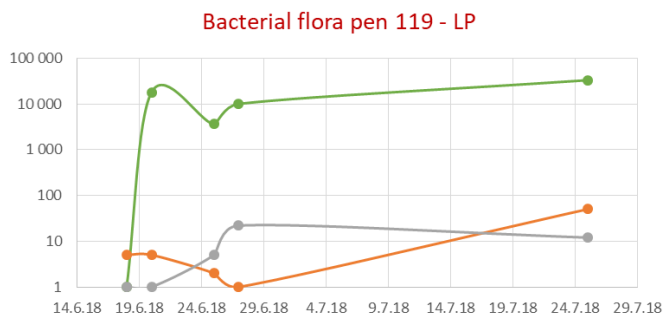


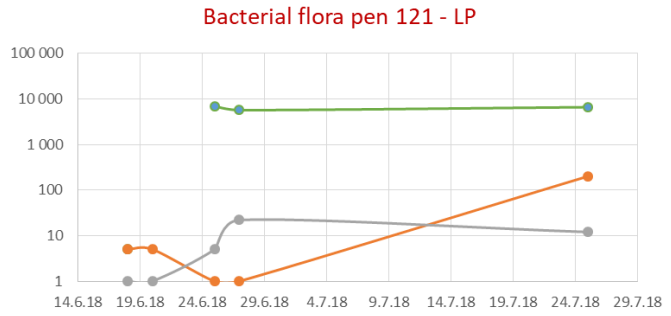


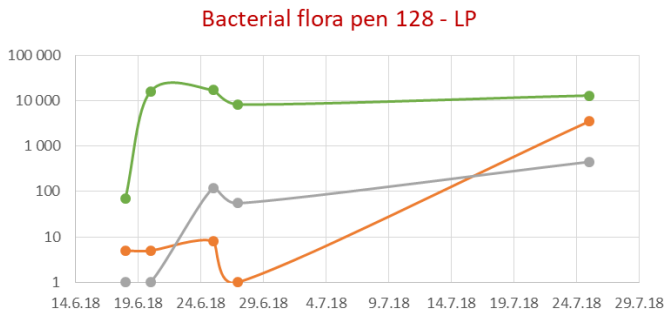


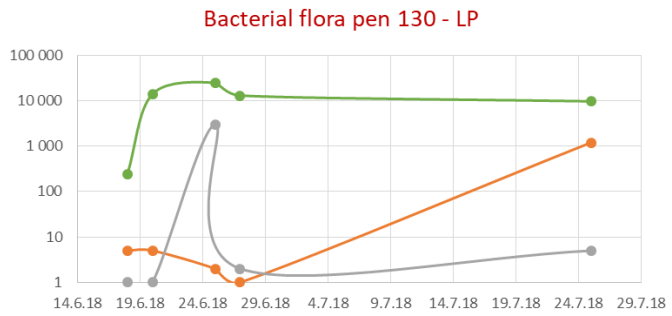






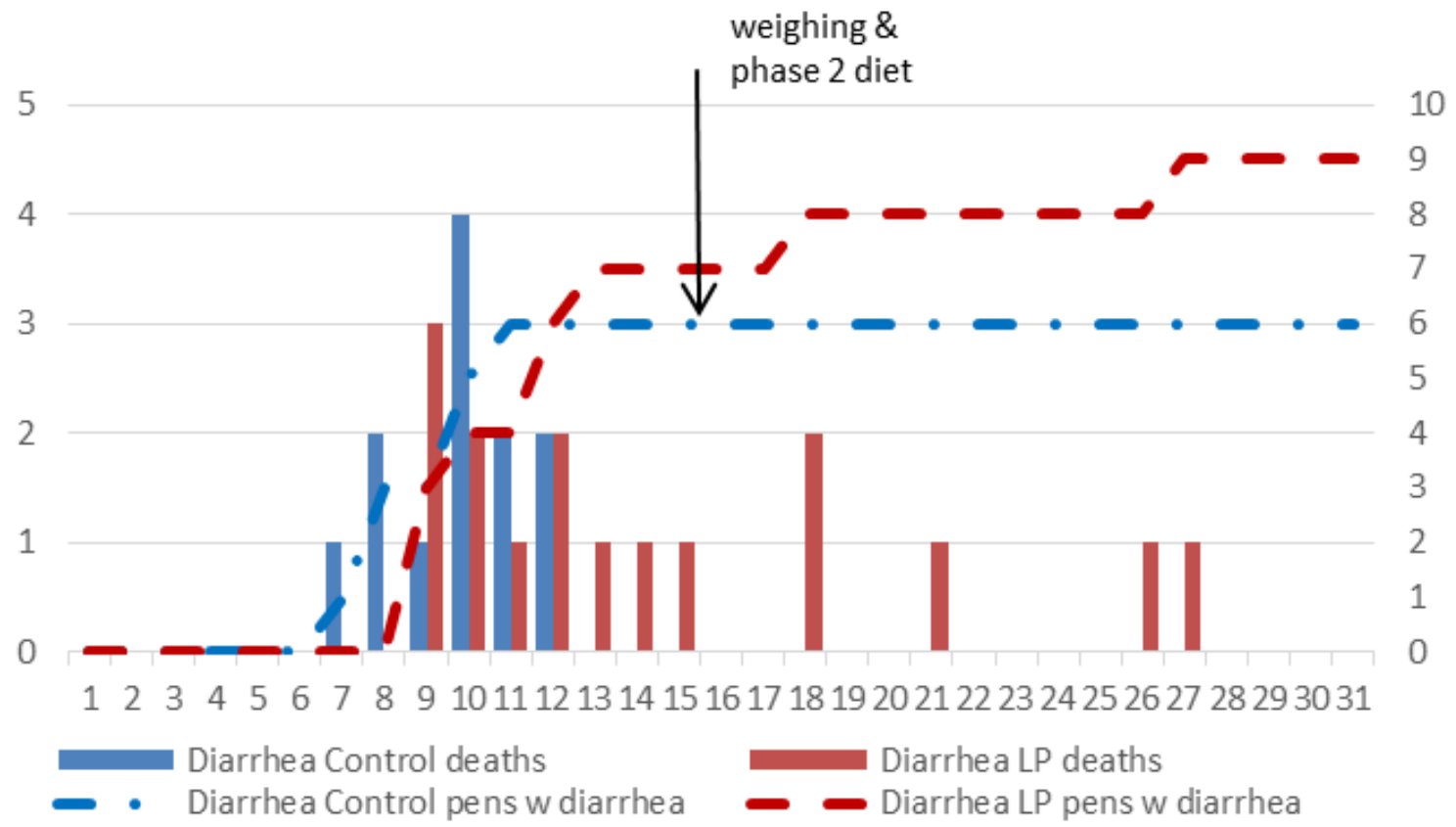






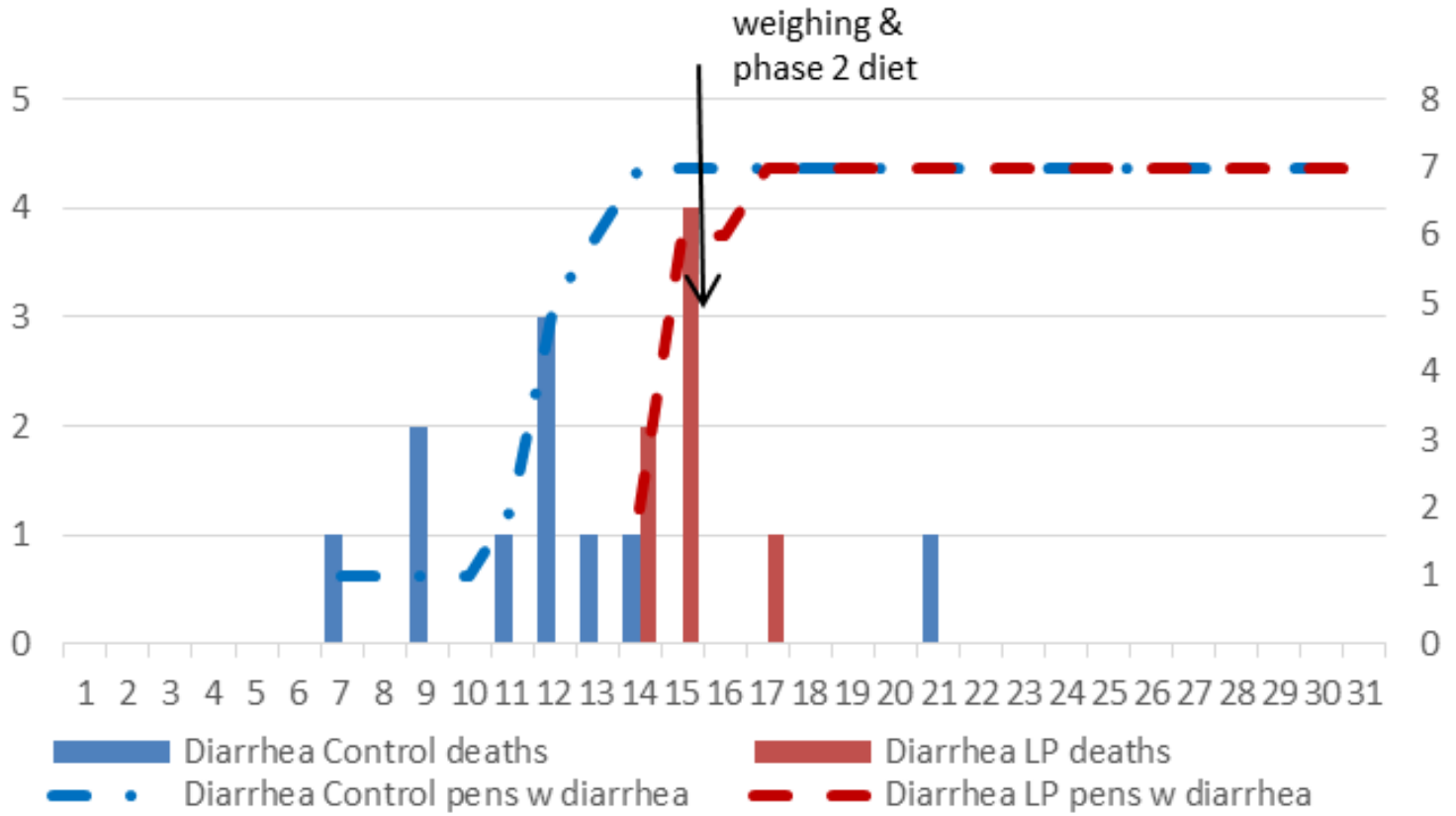
Losses from diarrhea over the post weaning period

- Number of losses by day and treatment in Trial 1



Losses from diarrhea over the post weaning period

- Number of losses by day and treatment in Trial 2

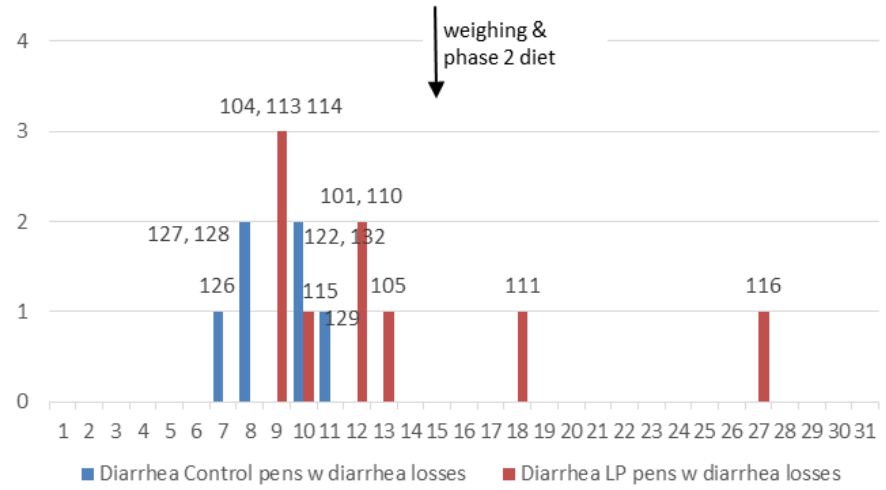


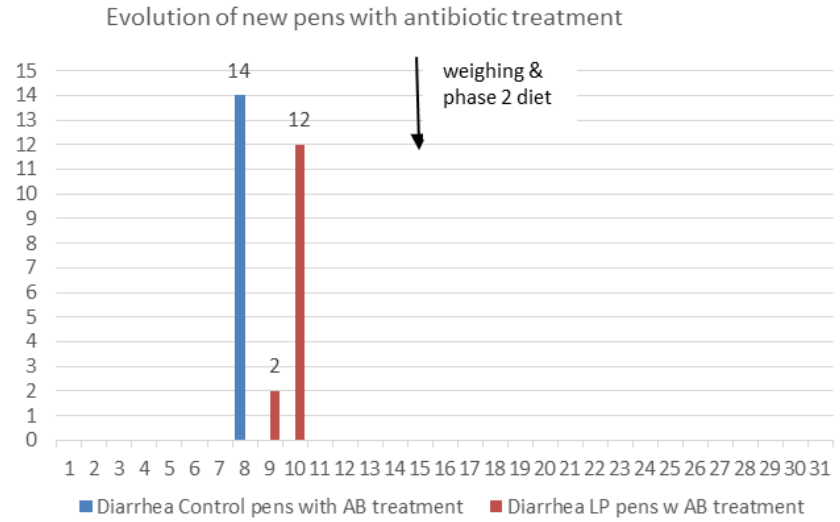
- Analytical diagnosis of infection
  - E. coli, rotavirus → secondary infection with E coli. K 88

Evolution of diarrhea disease over the post weaning period

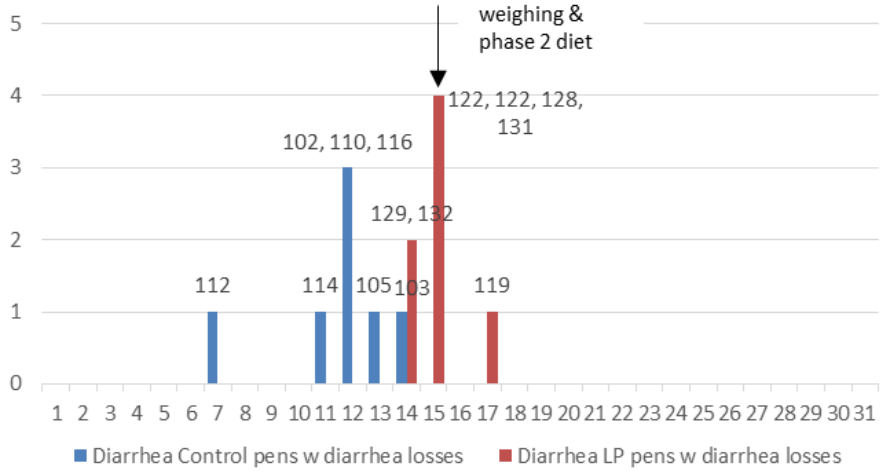
- New pens with losses
- New pens with treatments

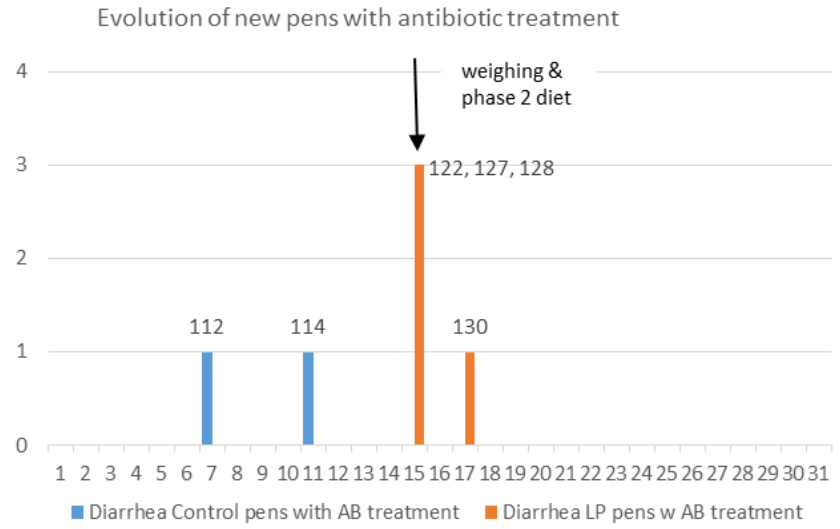
Trial 1





Trial 2

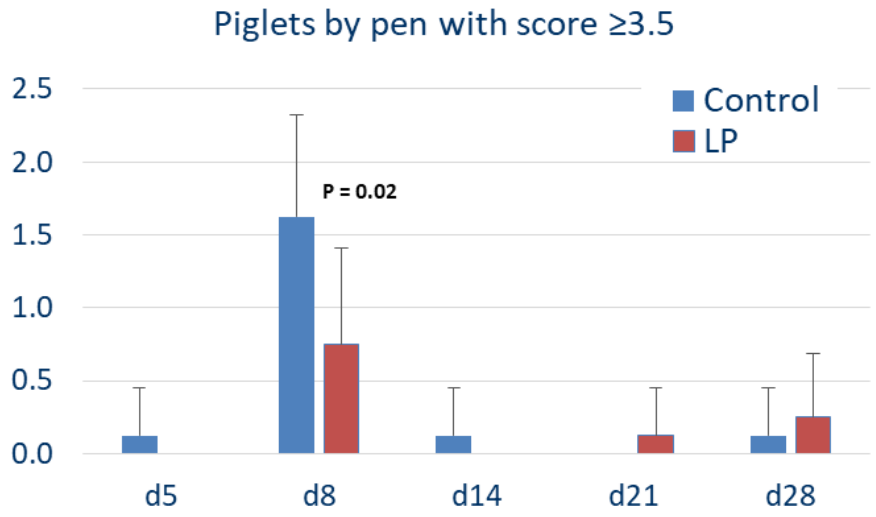


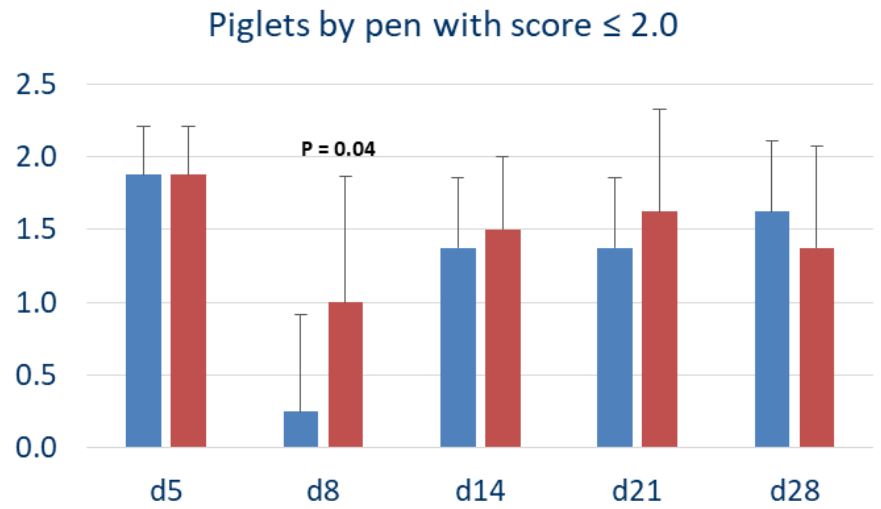


Scoring of faecal consistency

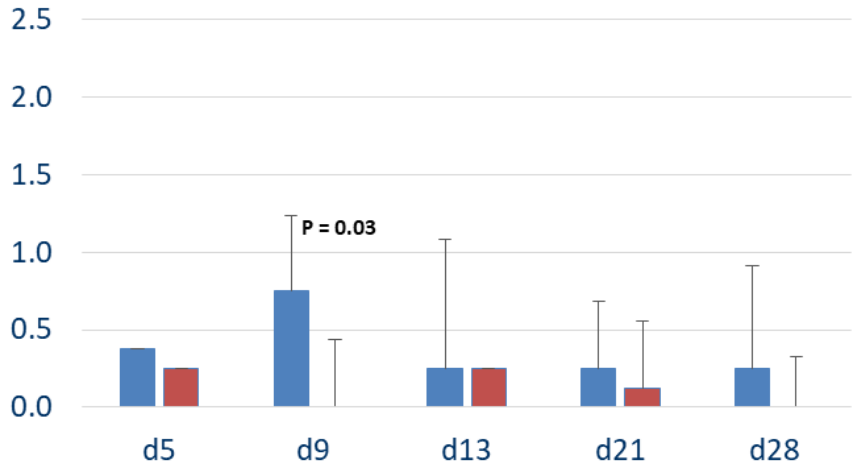
- piglets /pen with soft-liquid faeces
- piglets /pen with regular faeces

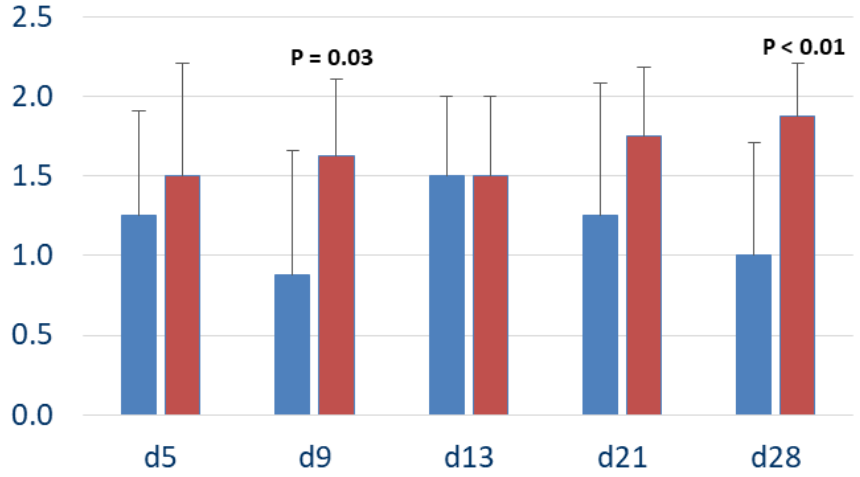
Trial 1



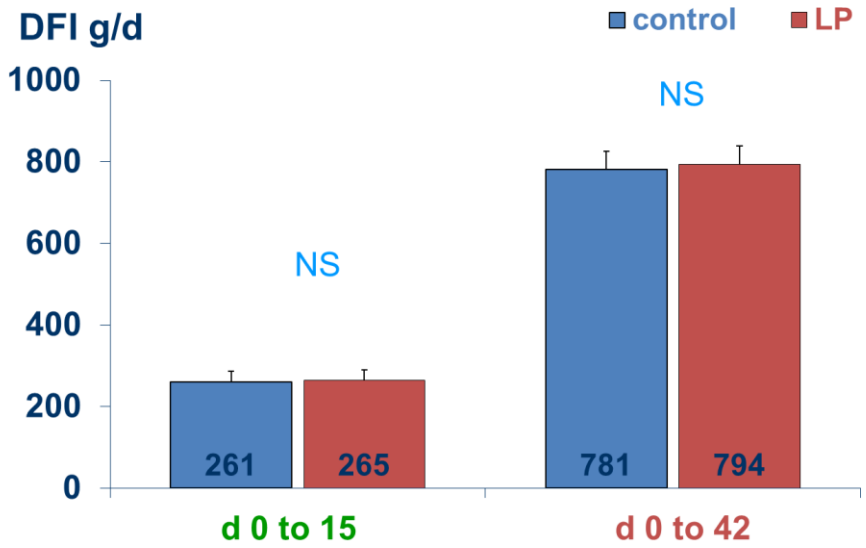


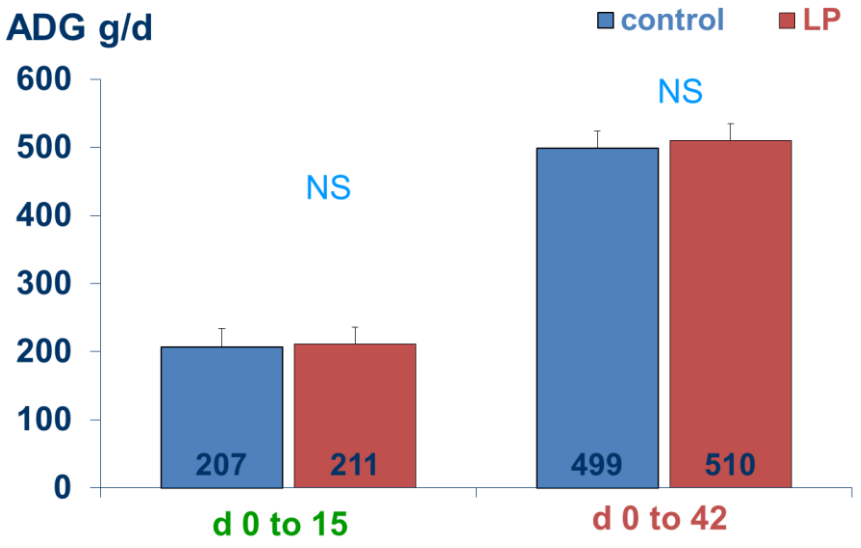
Trial 2

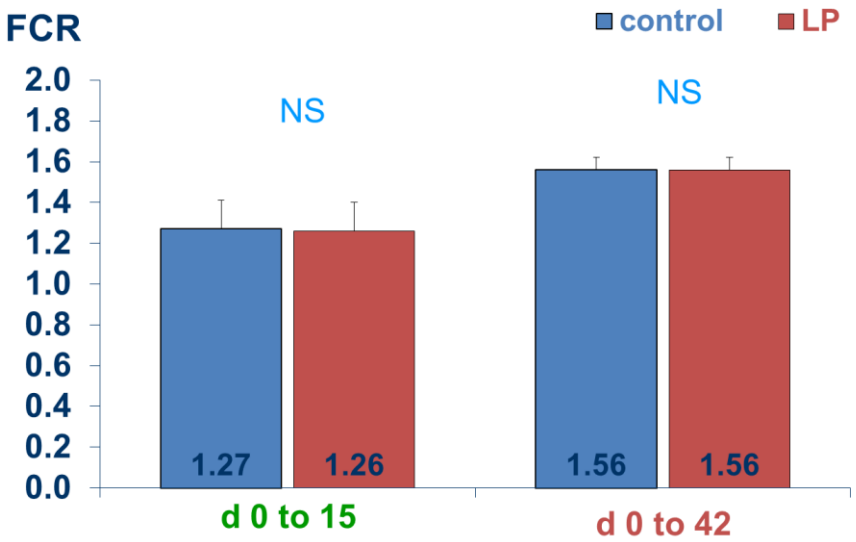




Performances : Trial 1

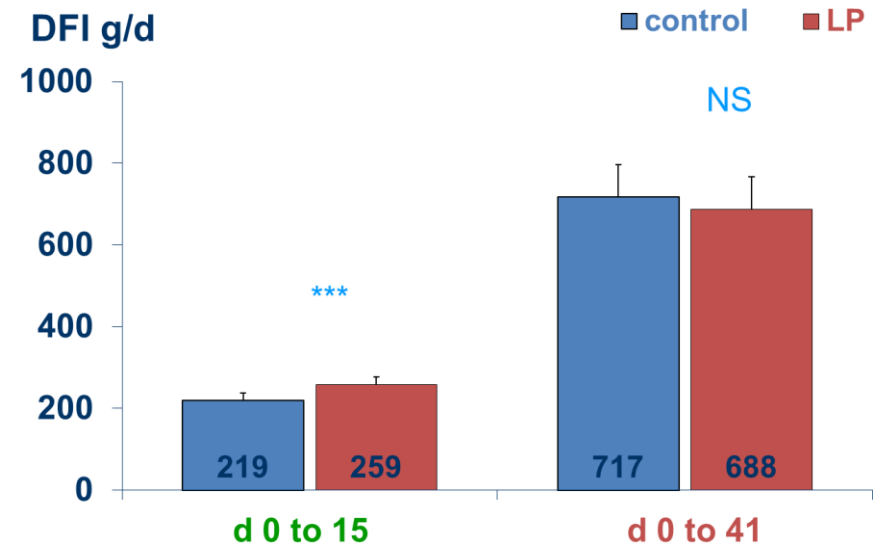


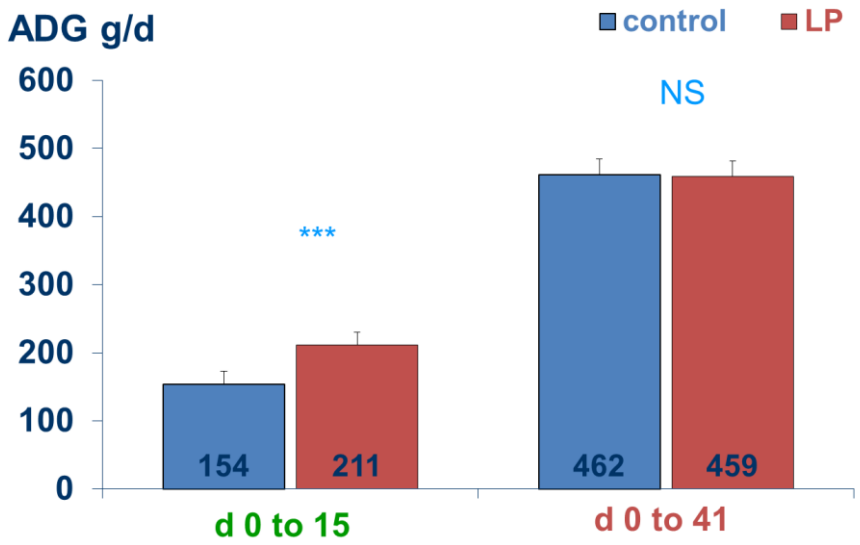


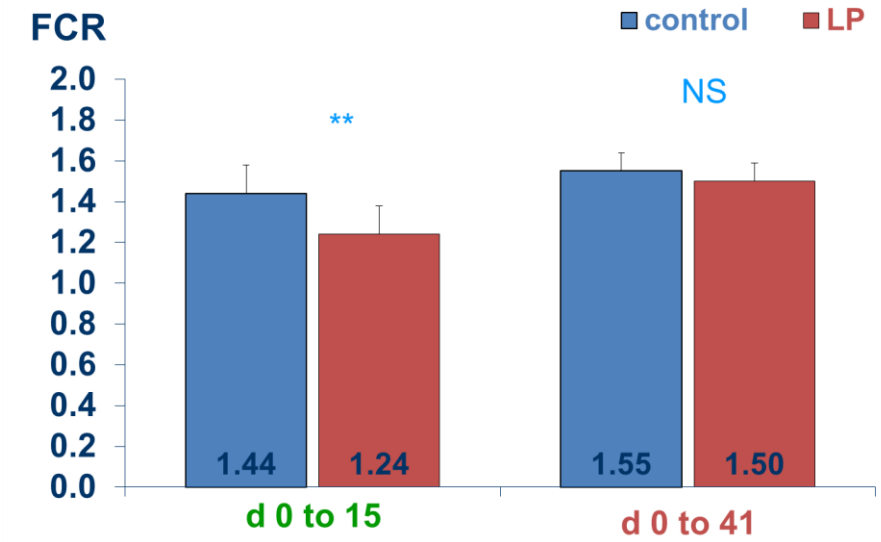


- By period :
  - Phase 1 period : NS
  - Phase 2 period : NS
  - Total post weaning : NS

Performances : Trial 2







- By period :
  - Phase 1 period : ↗ ADFI, ↗ ADG, ↘FCR
  - Phase 2 period : NS
  - Total post weaning : NS

Discussion & conclusions

- Lactobacillus & LAB can establish on surfaces of animal buildings and modify the flora
  - Spraying a beneficial flora on surfaces may result in a protective positive surface flora
  - LAB anti-microbial activity through bacteriocins or biogenic amines = inhibition, competition, exclusion, and displacement
    - Control of MRSA (Karska-Wysocki et al, 2010)
    - Inhibition of gram - & + pathogenic bacteria (Ammor et al, 2004, 2006; Maragkoudakis et al, 2006; Nomato, 2005; Charlier et al, 2008)
    - controlling L. monocytogenes biofilms (Unal Turhan et al, 2016; review by Camargo et al, 2018)
    - few studies performed in situ
  - Biofilm formation in food environment still poorly understood (Reviewed by Capitelli et al, 2014)

Discussion & conclusions

- A positive surface flora may help to better deal with weaning challenges
  - Similar number of deaths and medical treatments in a difficult pathogenic context.
    - Performance effect for a low-medium sanitary status (Corrégé et al, 2014)
  - Delay in diarrhoea events → competitive advantage for weanling piglets
    - More time after weaning to:
      - Restructure intestinal morphology and absorptive function, activate intestinal immune system, restore epithelial varrier function (reviewed by King et al, 2003)
      - Fight against pathogenic aggression

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Aknowledgments

- Romillé experimental centre
  - L. Saulnais, J.P. Commereuc, A. Debroise, D. Pilorget and K. Rocher (Station Expérimentale Romillé)
  - E. Gault, D. Loiseau and R. Richard (Ifip-institut du porc)
- Analyses
  - C. Loysance-Paroux (Labocea)
- Funding
  - Lallemand SAS
  - National program for agricultural and rural development (PNDAR)