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► To cite this version:

Charline Richard, Pauline M. Anton, Nelly Badalato, Marine de Koninck, Marie-Hélène Degrave, et al.. Improvement of the intestinal microbiota of weaned piglets with innovative nutritional solutions. Société Française de Microbiologie, Oct 2023, Rennes, France. hal-04294066

HAL Id: hal-04294066

<https://hal.science/hal-04294066v1>

Submitted on 24 Nov 2023

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Improvement of the intestinal microbiota of weaned piglets with innovative nutritional solutions

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Context

Weaning is a critical transition phase for health of farm monogastric animals and often requires antibiotic treatments. As an alternative, different nutritional solutions were evaluated for their effects on piglets digestive confort and intestinal microbiota.

Materials & Methods

In vitro experiment

After an *in vitro* gastro-intestinal digestion (4H shaking at 37°C), 2 strains, *E. coli* (CIP 54.127) and *E. faecalis* (CIP 76.117), were incubated in anaerobic conditions with the 3 ingredients tested: Ca-butyrate, tannins, a modified dextrin, their respective combinations and a control digestate (ultra-pure water).

In vivo experiment

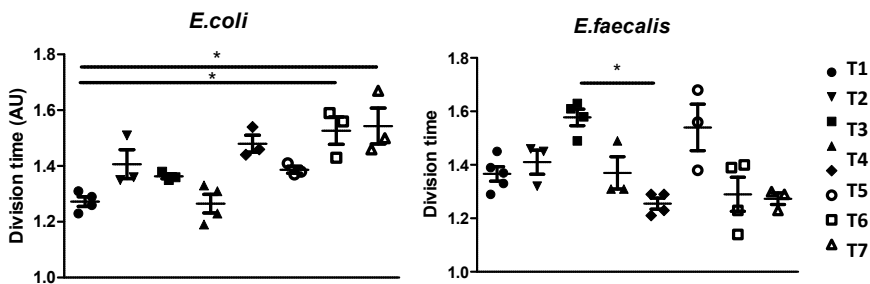
Two consecutive rounds, comprising each 192 freshly weaned piglets received 6 different nutritional solutions (T2 to T7) or no solution (T1). Fecal swabs were taken at arrival, day 14 and day 32. After DNA extraction, samples were processed through the *Metabiote® Solution* (16S rRNA sequencing on MiSeq Illumina) for characterization of bacterial communities and statistical analyses.

Treatments	Composition
T1	Basal diet (BD) (control)
T2	BD + Ca-butyrate
T3	BD + Tannins
T4	BD + modified dextrin
T5	BD + Ca-butyrate + Tannins
T6	BD + Tannins + modified dextrin
T7	BD + Ca-butyrate + Tannins + modified dextrin

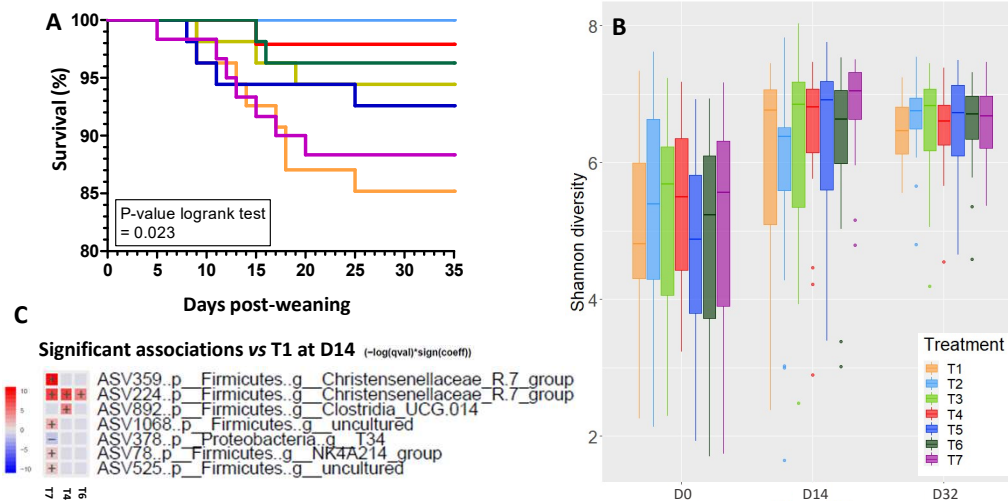
Results – in vitro

- Significant increase of division time of *E. coli* when exposed tannin+modified dextrin or the combination of the 3 ingredients
- Decrease of division time of *E. faecalis* when exposed to the combination of the 3 while increase when exposed to tannins

Variations of division time in vitro for the two strains tested



Zootechny results of survival rate (A), Alpha diversity (B) and statistical analysis (Maaslin2) (C) of the gut bacterial community for a subset of samples (B)



Results – in vivo

- The control group (T1) showed the highest mortality rate (~15%) compared to other groups
- An increased bacterial diversity over time showing colonization of piglets' gut during weaning with stabilization
- No strong distinction between treatment groups
- At day 14 with the modified dextrin with and without tannins and the combination of the 3 ingredients :
 - Significant increase of ASVs belonging to *Christensenellaceae* (relative abundance)
 - Decrease of ASVs belonging to *Escherichia* (not significant, not shown)

Conclusion

These results confirmed that weaning is a crucial step for intestinal bacterial colonization. The nutritional solutions tested have different impact on gut bacteria with potential to improve weaned piglets' health, especially when containing tannins, through the balancing of the microbiome composition and selection of beneficial genera.