

Calf rearing in dairy farms: at the crossroads between microbial transmission and welfare

Voland. L¹, Martin, B.^{1.}, Nicolao, A.¹, Pomies, D.¹, Mathieu, A.¹, Koczura, M.¹, Bouchon, M.², Constant, I.¹, Popova M.

¹ Université Clermont Auvergne, INRAE, VetAgro Sup, UMR Herbivores, F-63122 Saint-Genès-Champanelle, France

² Université Clermont Auvergne, INRAE, UE Herbipole, F-15203 Marcenat, France



Introduction

Maternal influence

Gastrointestinal tractus of ruminant =
host health

**rumen microbiota colonization: 3
key moment**

- Birth-2d,
- before weaning,
- after weaning

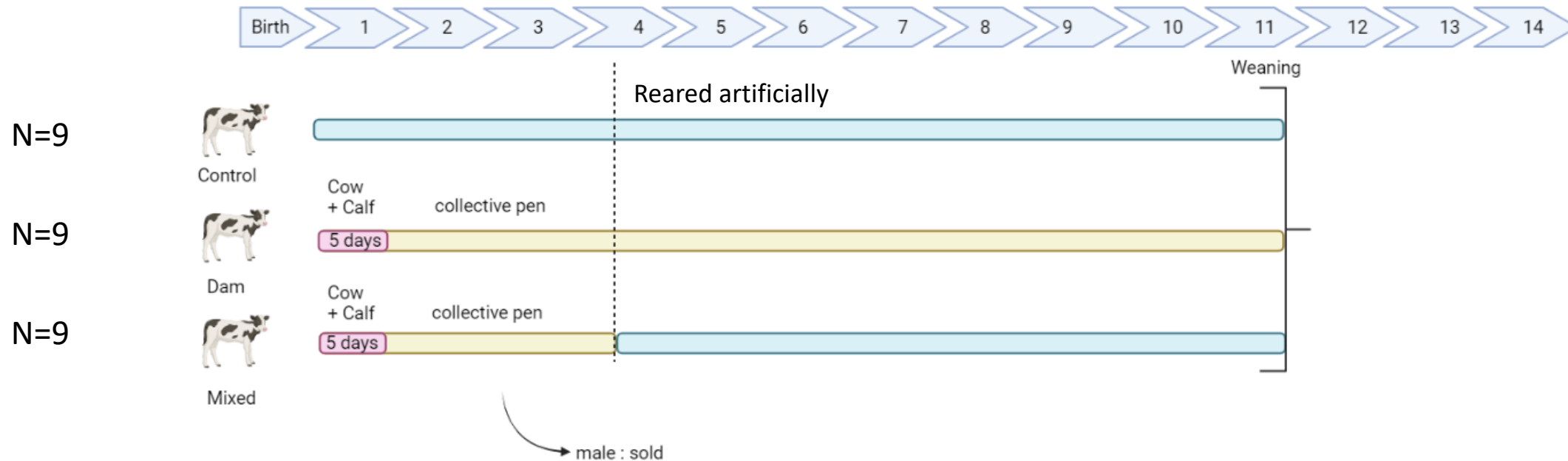
Problem Rearing dairy calves on European dairy farms :

- 1) loss of natural/social behaviors
- 2) increased occurrence of certain diseases
- 3) smaller calves.
- 4) induce a negative effect on rumen development could be due to differences in microbes' colonization

**Hypothesis : Delayed separation could be a trade-off between
animal welfare and farmers' profits.**



Trial design



Breed :

-Holstein

-Montbéliarde

- Growth
- Rumen microbiota : metataxonomy
- Rumen microbiota fermentation products



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Result : Growth

Rearing ($p = 0,0295$)
 Time* Rearing ($p < 0,0001$).
 Time ($p < 0,0001$).

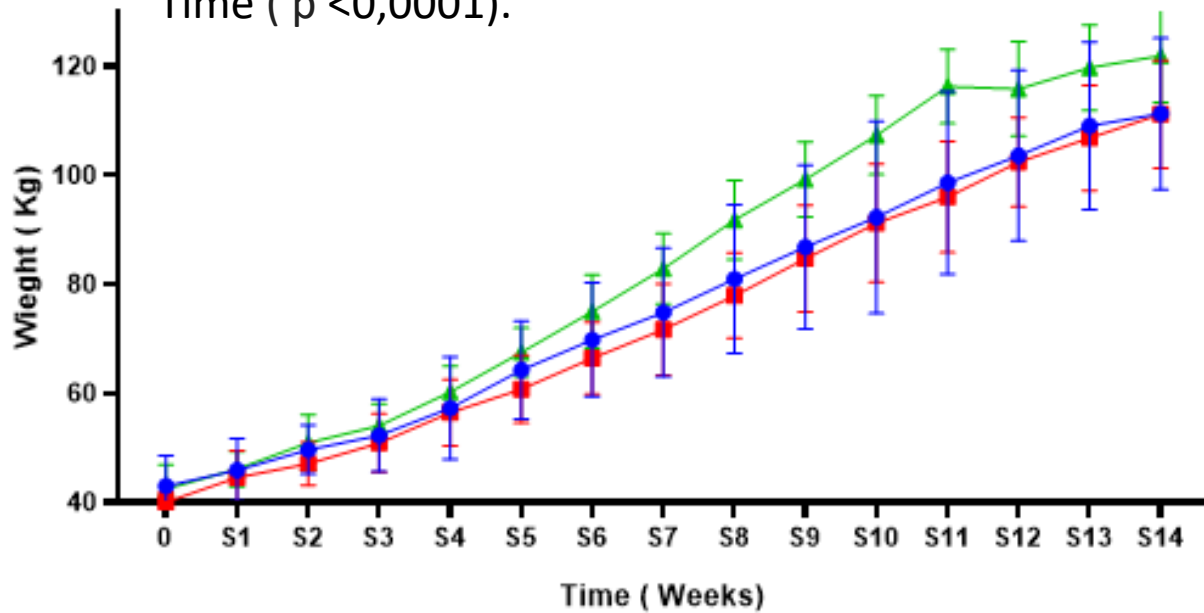
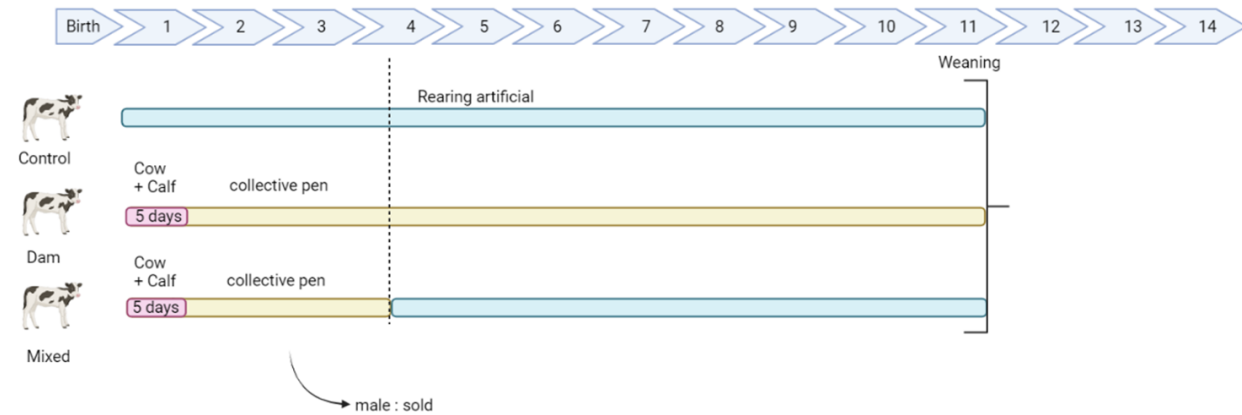


Fig. 1. Average weight calves (Graph pad Prism 8). Error bars indicate SEM.



● Control
 ■ Dam
 ▲ Mixed

MIXED : improved growth vs DAM and Control.

Rearing practices have an impact on the growth of calves between the age of 4 weeks and two weeks after weaning.



Result: Taxonomy

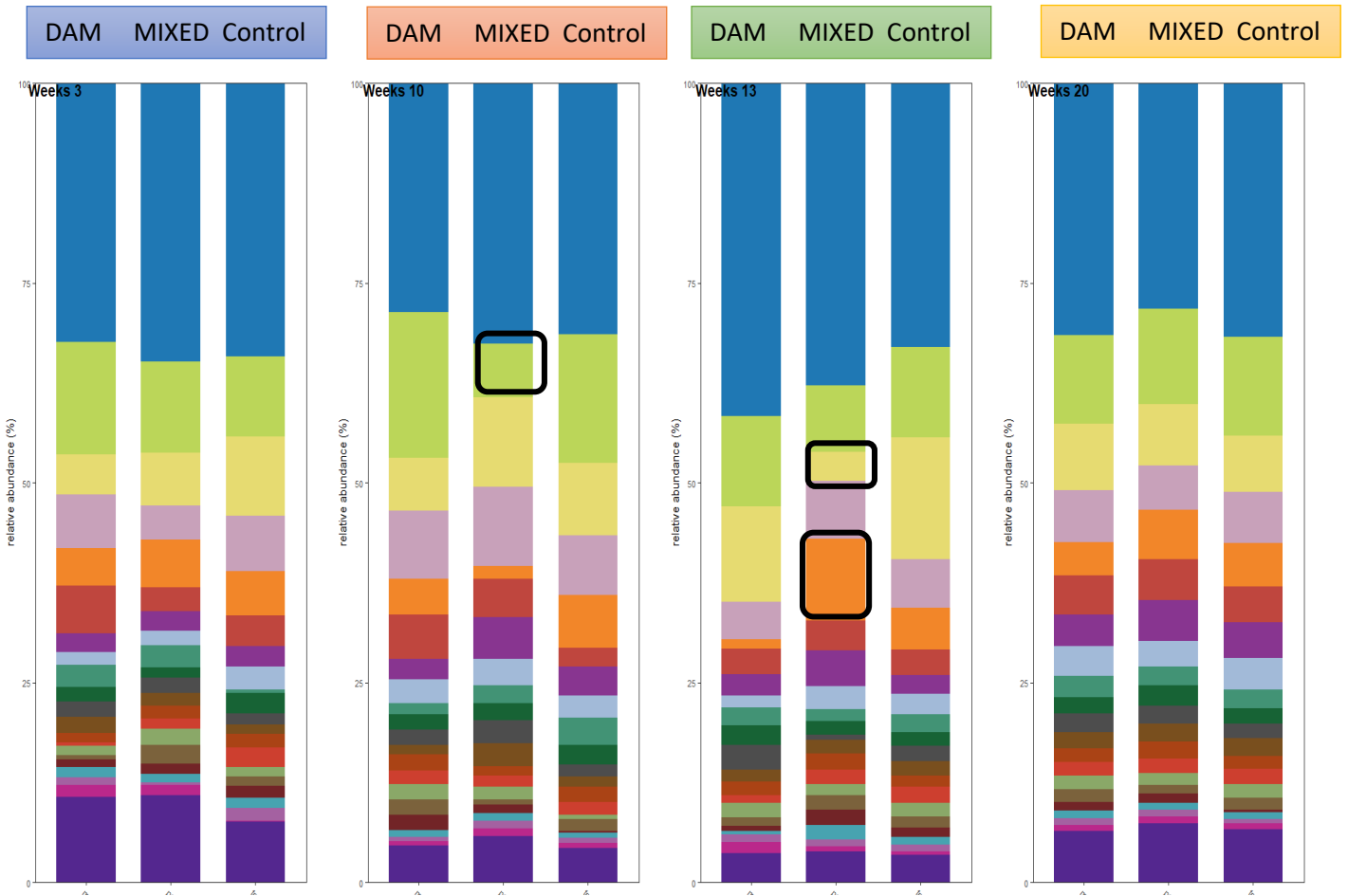


Fig 2: Family-level composition of rumen bacteria of dairy calves.

Change taxonomy during time -> alimentation
 Difference : change in relative abundance between groups during one time

3 weeks

- f Prevotellaceae
- f Rikenellaceae
- f Lachnospiraceae
- f Succinivibrionaceae
- f Oscillospiraceae
- f F082
- f Christensenellaceae
- f Desulfovibrionaceae
- f Bacteroidales_RF16_group
- f Spirochaetaceae
- f Acidaminococcaceae

10 weeks

- f Prevotellaceae
- f Succinivibrionaceae
- f Rikenellaceae
- f Lachnospiraceae
- f Selenomonadaceae
- f Christensenellaceae
- f Bacteroidales_RF16_group
- f Oscillospiraceae
- f F082
- f Acidaminococcaceae
- f Hungateiclostridiaceae

13 weeks

- f Prevotellaceae
- f Lachnospiraceae
- f Succinivibrionaceae
- f Rikenellaceae
- f Bacteroidales_RF16_group
- f Spirochaetaceae
- f Fibrobacteraceae
- f Christensenellaceae
- f Selenomonadaceae
- f F082
- f Erysipelatoclostridiaceae

20 weeks

- f Prevotellaceae
- f Rikenellaceae
- f Lachnospiraceae
- f Christensenellaceae
- f Fibrobacteraceae
- f WCHB1-41
- f Bacteroidales_RF16_group
- f Oscillospiraceae
- f Hungateiclostridiaceae
- f Acholeplasmataceae
- f F082

Succinivibrionaceae :
 D :11,05% M :4,94 % C : 10,10 %
 A B

Prevotellaceae :
 D : 42,3% M: 34,1 % C :29,9%
 A B

Succinivibrionaceae :
 D : 6,49 % M :2,71 % C : 11,18 %
 A B

Bacteroidales_RF16_group :
 D : 0,68 % M :7,31 % C :3,59%
 A B C

P ajust bonferroni < 0,05



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Result: Beta diversity

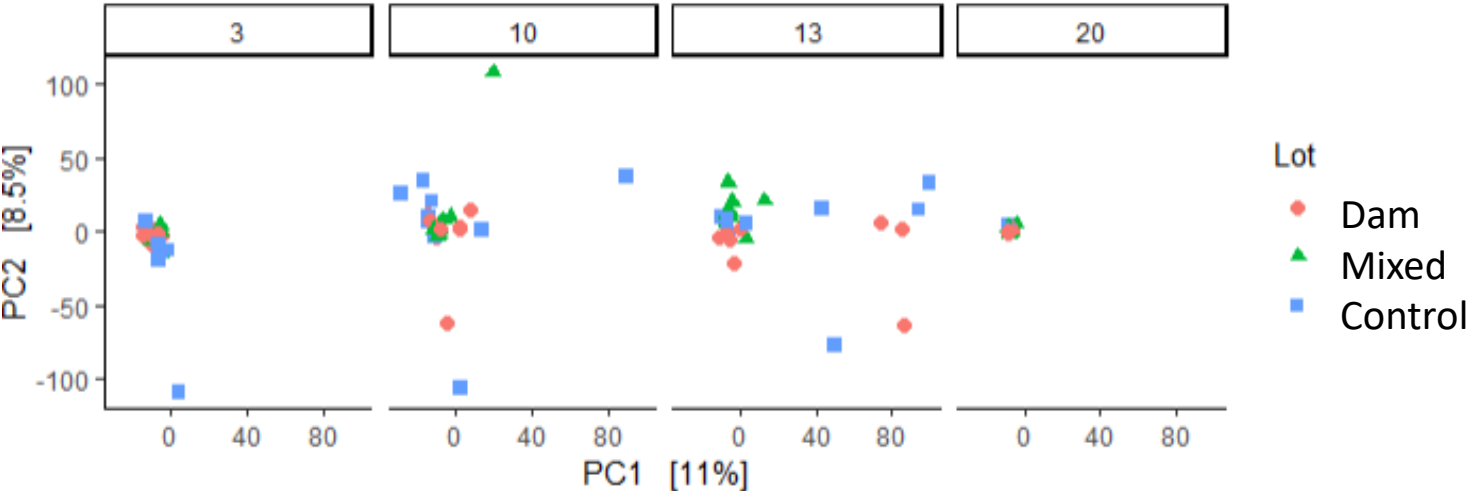


Fig 3: Principal Coordinate Analysis (PCoA) of Bray curtis distances at different weeks (3, 10,13 ,20)

3 weeks : DAM & Mixed : no difference
 -> DAM and Mixed : rearing with their dams

10 weeks (before weaning): all different
 -> all rearing are different

13 weeks (after weaning) : DAM & Control no difference
 -> weaning

20 weeks : DAM & Mixed different
 -> late separation and weaning

Week 3			Week 10			Week 13			Week 20		
Control Dam	Control Mixed	Dam Mixed	Control Dam	Control Mixed	Dam Mixed	Control Dam	Control Mixed	Dam Mixed	Control Dam	Control Mixed	Dam Mixed
0,002	0,005	ns	0,012	0,002	0,004	ns	0,011	0,002	ns	ns	0,004

Table 1 : Pairwise comparaisn with ADONIS (p_value with BH on Bray curtis distances)



Result: Volatile fatty acid

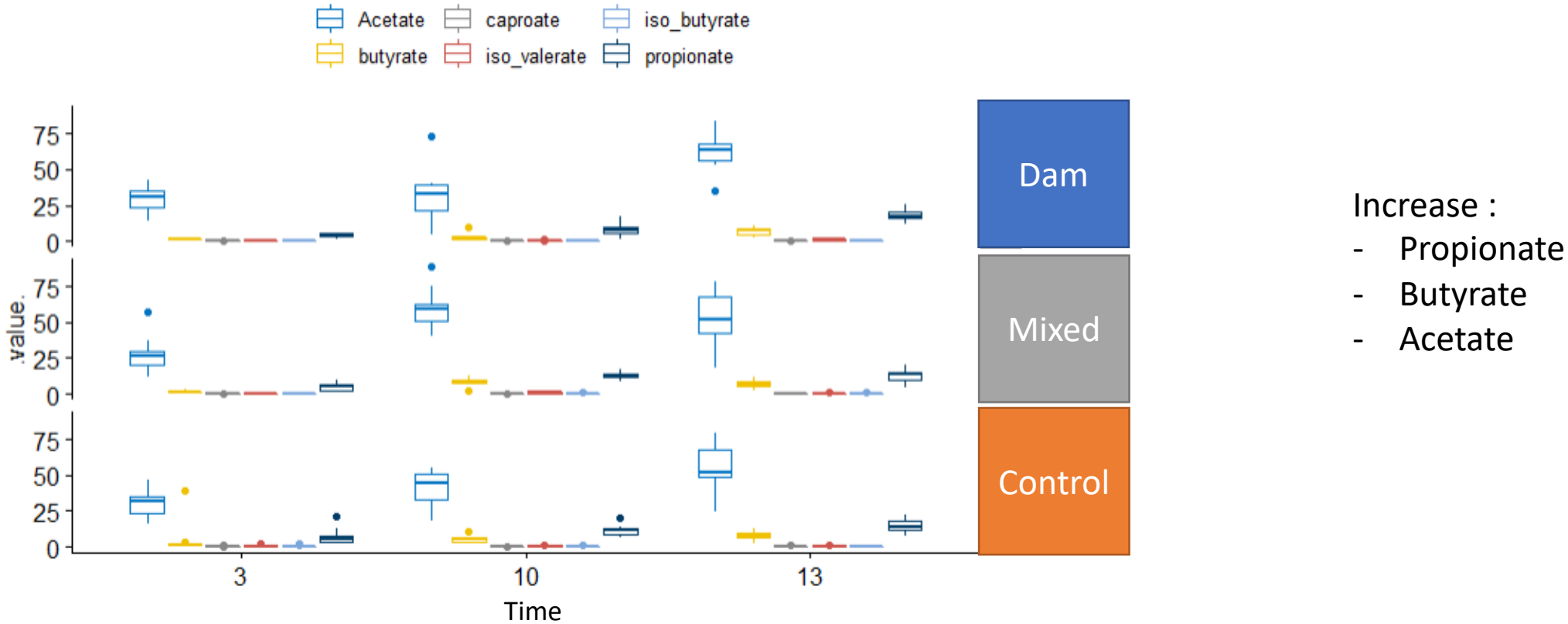


Fig 4. Boxplot of VFA rumen calves, expressed by group/rearing system and by week of age.



No rearing effect
Time effect

solid organic matter with time



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Take home message



Rearing practices influence gut microbiota and these shifts affect host's performances (growth)

Late separation (Mixed)

- No effect no end-fermentation product
- Some change in abundance microbiota
- Double effect : separation and weaning



ongoing work:
link gut microbiota to immunity and disease occurrence and stress indicators (Cortisol)





Thank you
laurianne.voland@inrae.fr

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