

Impact of early-life changes on pigs' health, growth and welfare in a commercial farm

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Weaning: the most stressful event in a piglet's life



Weaning



CHALLENGES

- Separation from the mother
- Diet change
- Mixing with unfamiliar congeners
- Environment change
- Vaccination

CONSEQUENCES

- Increased number of conflicts (body injuries, tail-biting behaviours)
- Reduced feed intake and growth slow-down
- Impaired development of intestinal barrier function
- Delayed immune system maturation
- Increased risk of gastrointestinal disorders and associated mortality

Degroot *et al.*, 2001 ; Melin *et al.*, 2004 ; Moeser *et al.*, 2007a,b ; Smith *et al.*, 2010 ; Campbell *et al.*, 2013

Alternative rearing systems to reduce animal stress

Alternatives	Positive points
Free-farrowing pen	Reduces mother and piglets' stress Improves piglets' performances
Early-socialization	Accelerates hierarchy's establishment Reduces aggressive behaviours at weaning
Environment's enrichment	Limits tail-biting behaviours
End of mutilations (castration and tail-docking)	

D'Eath *et al.*, 2005 ; Camerling *et al.*, 2018 ; Buijs and Muns., 2019 ; Morgan *et al.*, 2021

Aim of the study

To compare the consequences of alternative rearing conditions to standard ones, on pigs' health, performances and welfare, in a conventional commercial farm.

Experimental protocol

Standard
n=75

Tail docking

Farrowing crate

28-day-long sow restraint



Birth

Slaughter

Alternative
n=80

No tail docking

Free-farrowing pen

2-day-long sow restraint



Experimental protocol

Standard
n=75

Tail docking
Farrowing crate

Maternity

d9

early-socialization

No tail docking
Free-farrowing pen

Alternative
n=80

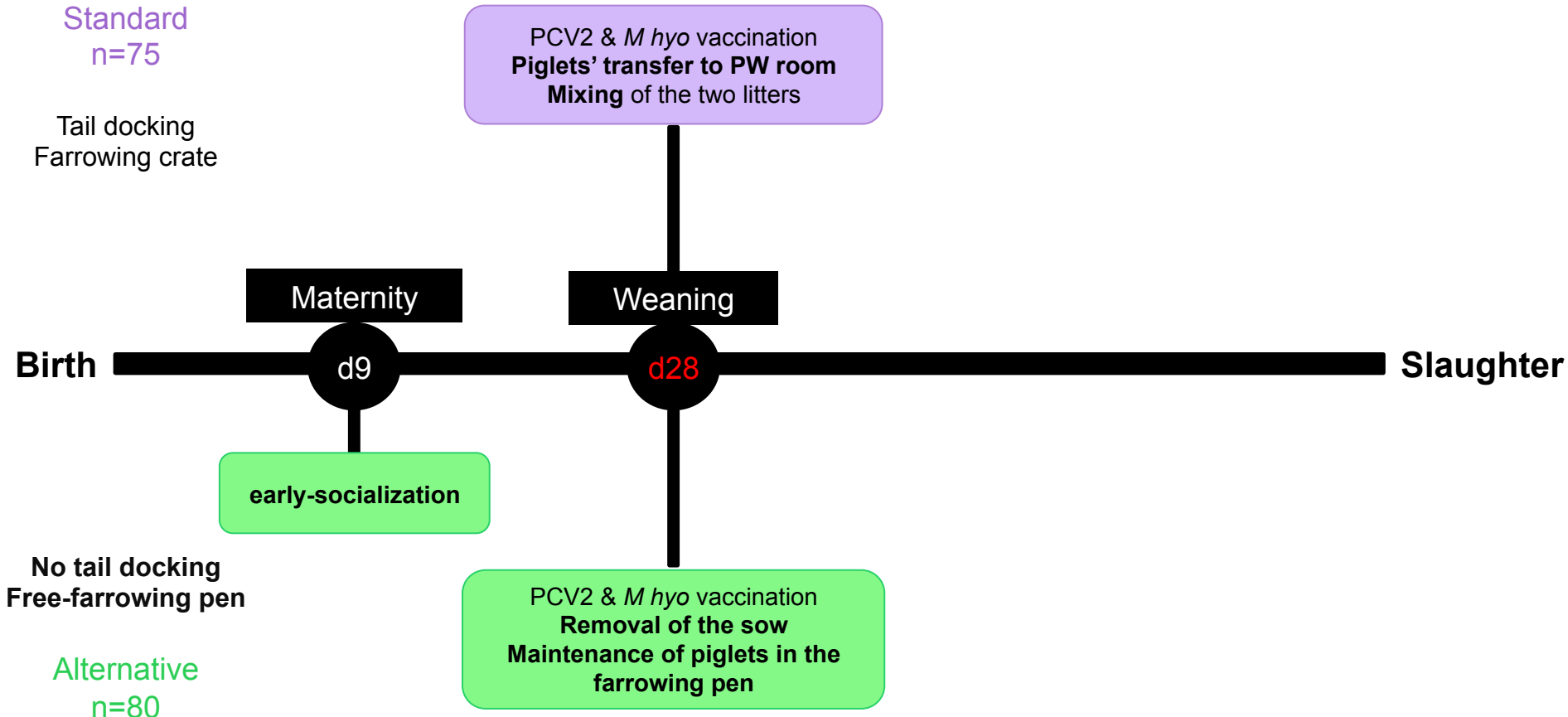


Tunnel allowing the mixing of the two litters' piglets

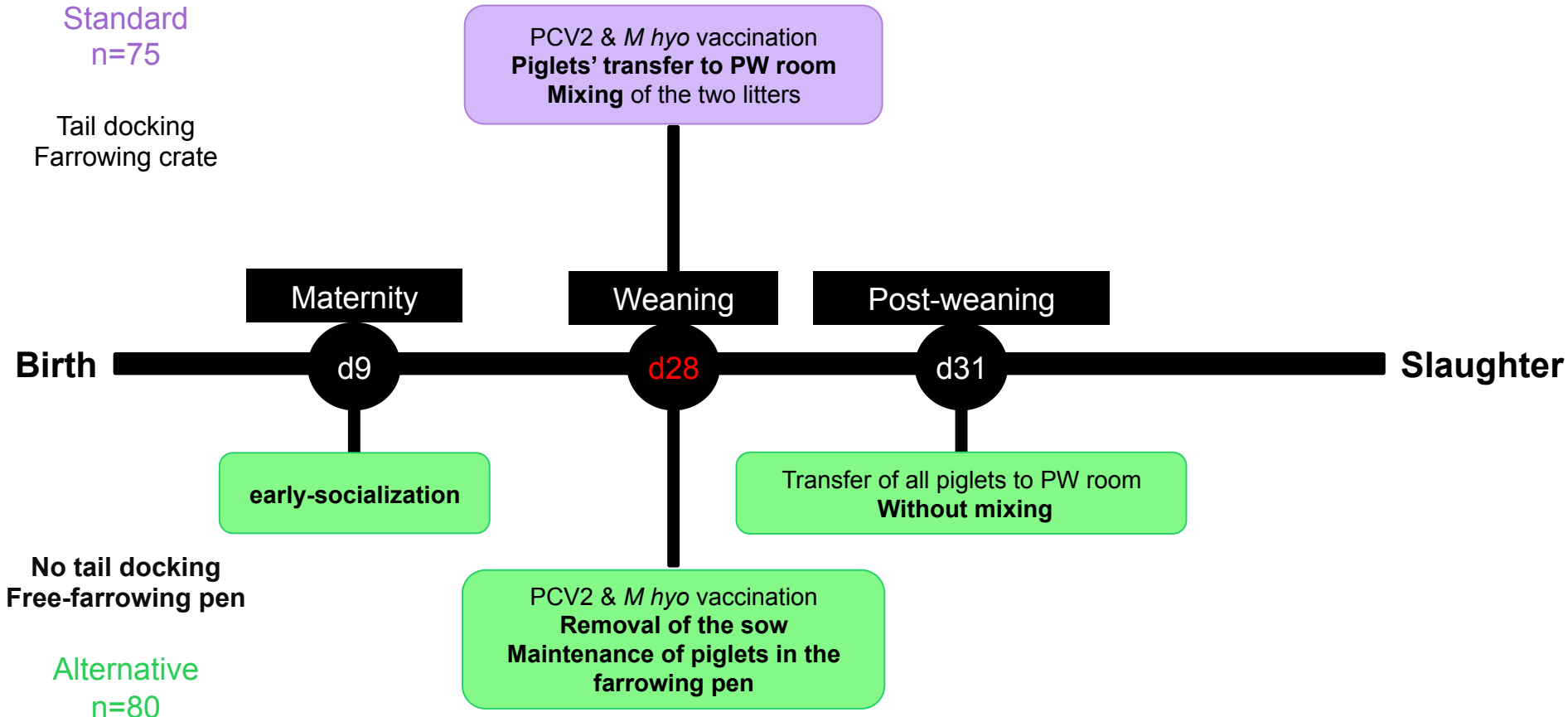
Birth

Slaughter

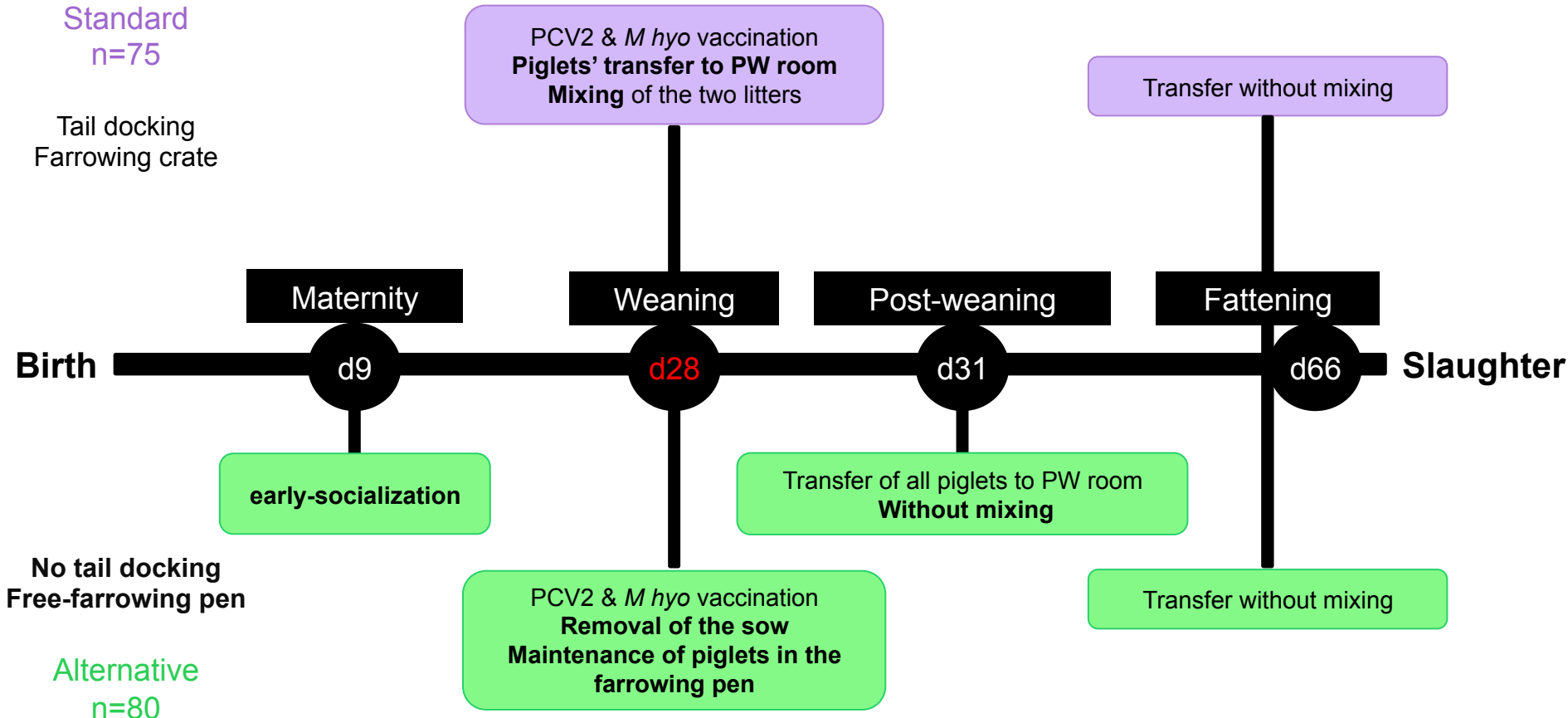
Experimental protocol



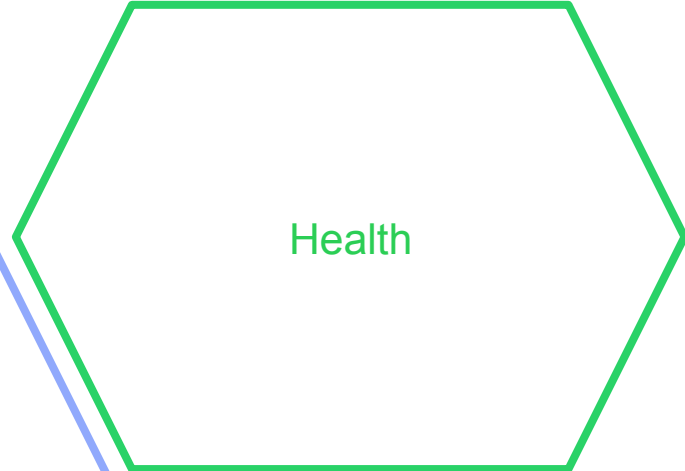
Experimental protocol



Experimental protocol



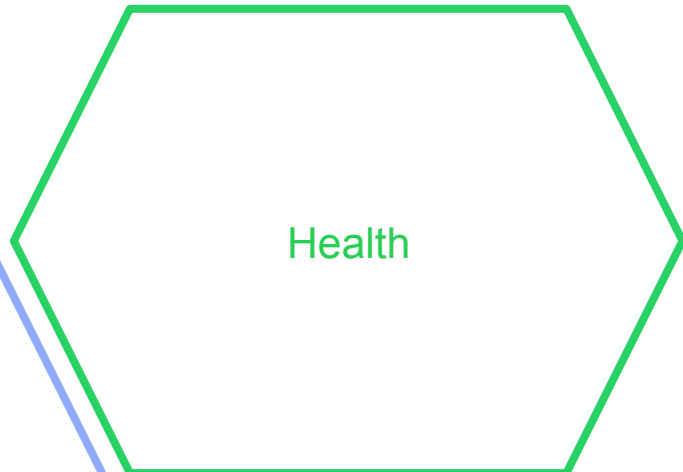
Summary of measurements and samples taken from the animals



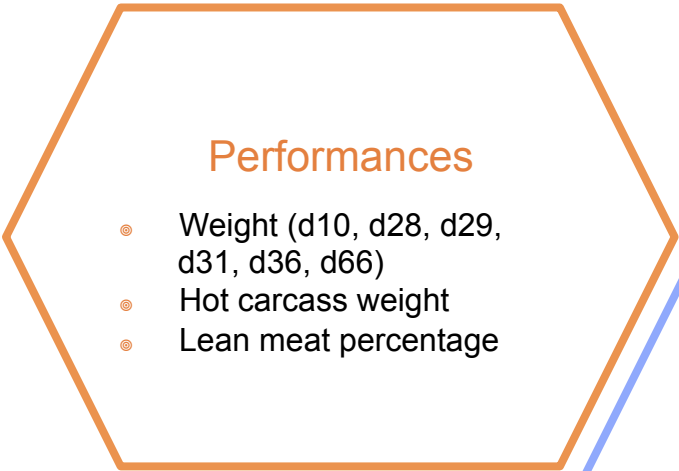
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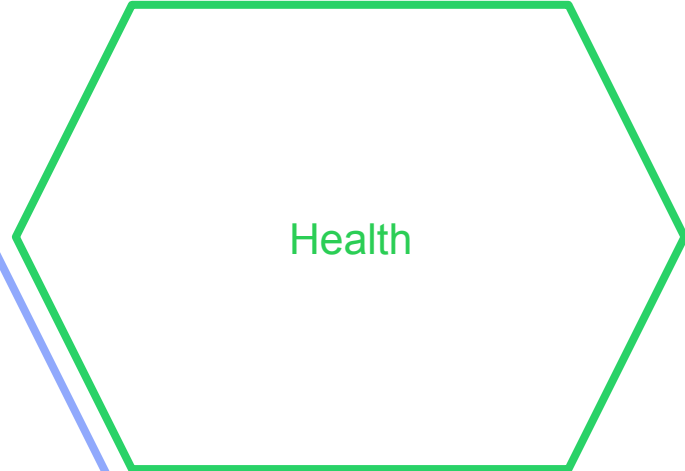
Samples taken only from ♂
n = 79 ind



Summary of measurements and samples taken from the animals



Samples taken only from ♂
n = 79 ind



Summary of measurements and samples taken from the animals

Performances

- Weight (d10, d28, d29, d31, d36, d66)
- Hot carcass weight
- Lean meat percentage

Samples taken only from ♂
n = 79 ind

Health

Immune competence

Aggressiveness

- Body injury score (d10, d28, d29, d36, d66)
- Tail injury score (d36, d66)

Stress mediators

Summary of measurements and samples taken from the animals

Performances

- Weight (d10, d28, d29, d31, d36, d66)
- Hot carcass weight
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Aggressiveness

- Body injury score (d10, d28, d29, d36, d66)
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Samples taken only from ♂
n = 79 ind

Immune competence

- **Blood count** (d29, d36, d66)
- **Serum IgG** (d66)
- **Anti-PCV2 vaccine response** (d66)
- **Whole Blood Assay** (d36, d66)
- **Phagocytosis** (d36, d66)
- **Circulating IL-6 assay** (d29)
- **Lymphocyte phenotyping** (d29, d36, d66)

Health

Stress mediators

Summary of measurements and samples taken from the animals

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Health

- Inflammation : **CRP** (d29, d36), **haptoglobin** (d66)
- Clinical signs
- Intestinal permeability : **endotoxin** (d29, d36), **D-lactate** (d28)
- **Insulin, IGF1** (d28)

Stress mediators

Summary of measurements and samples taken from the animals

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- Weight (d10, d28, d29, d31, d36, d66)
- Hot carcass weight
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Aggressiveness

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Health

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- **Insulin, IGF1** (d28)

Stress mediators

- **Plasma catecholamines** (d28, d29)
- **Serum cortisol** (d28, d29)
- **Hair cortisol** (d36, d66, d155)

Statistical analysis

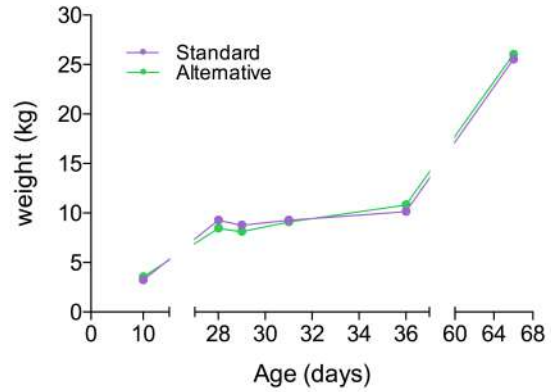
⇒ Mann-Whitney test: body and tail injury score, ADG (raw data)

⇒ Fisher's exact test: percentage of injured animals (raw data)

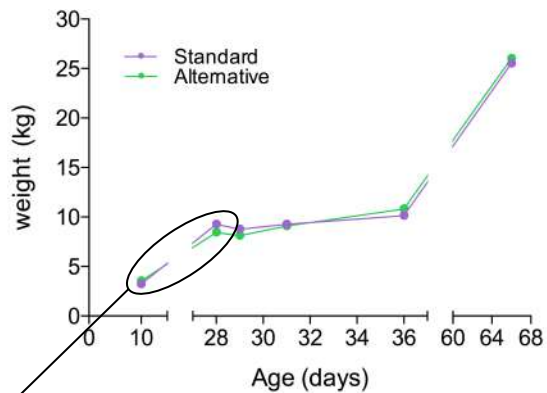
⇒ Linear mixed effect model : other parameters (lsmeans of transformed data)

- fixed effects : rearing conditions and piglet's age
- random effects : individual, batch, current mother, adoption status

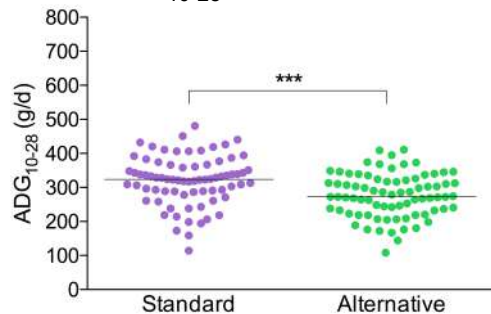
Effects of rearing conditions on pigs' performances



Effects of rearing conditions on pigs' performances

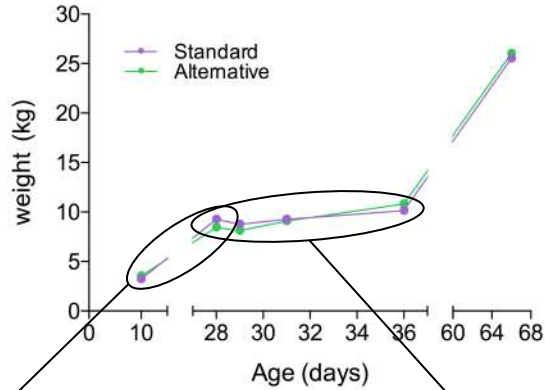


ADG₁₀₋₂₈ : lactation period

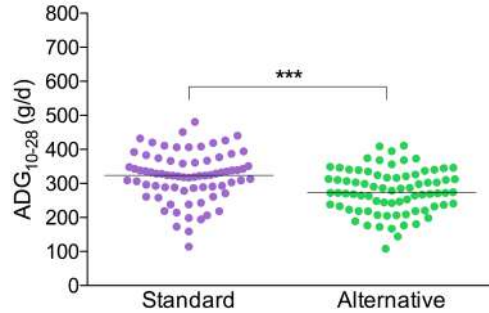


More competition for udders
due to early socialization

Effects of rearing conditions on pigs' performances

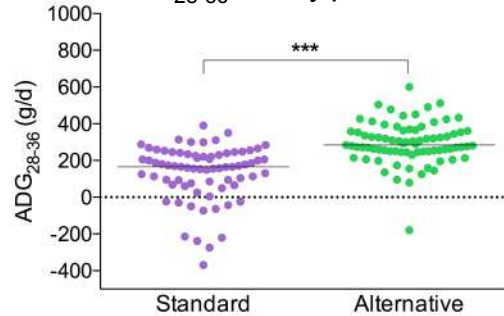


ADG₁₀₋₂₈ : lactation period



More competition for udders
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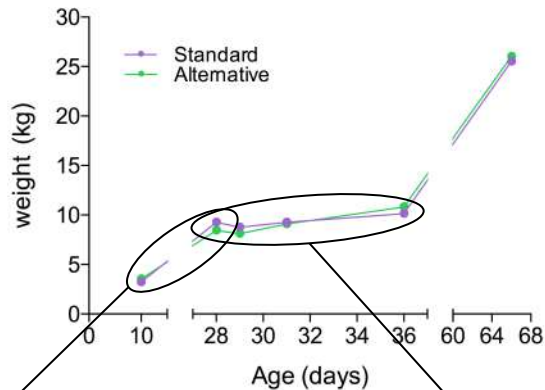
ADG₂₈₋₃₆ : early post-weaning



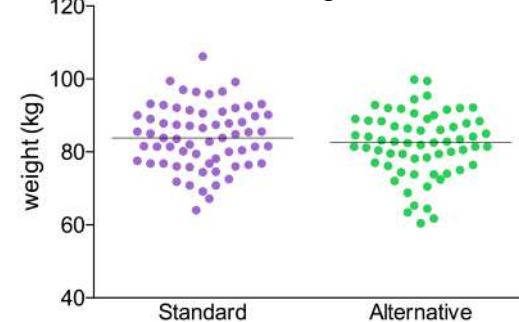
Best growth rate for piglets
reared under alternative conditions
thanks to early socialization

Effects of rearing conditions on pigs' performances

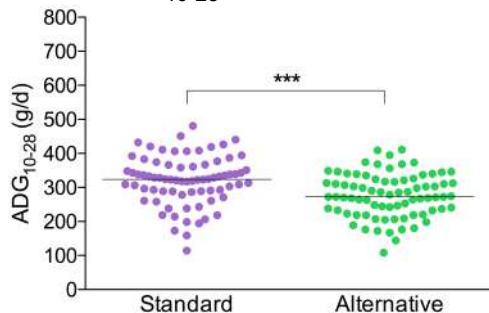
At slaughter



Hot carcass weight $p=0.158$

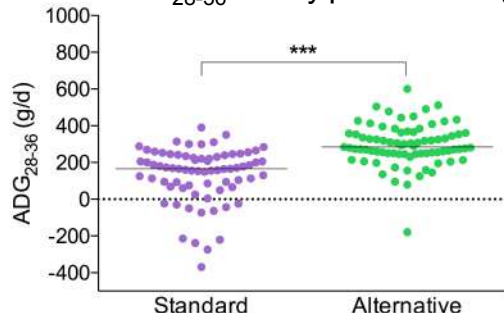


ADG_{10-28} : lactation period



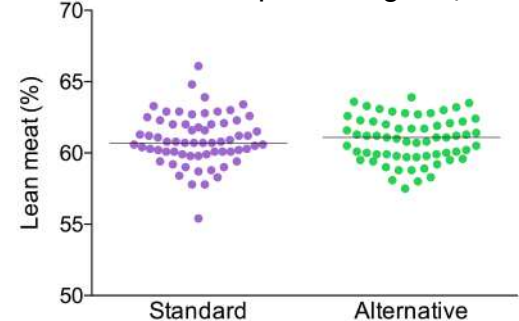
More competition for udders due to early socialization

ADG_{28-36} : early post-weaning



Best growth rate for piglets reared under alternative conditions thanks to early socialization

Lean meat percentage $p=0.809$

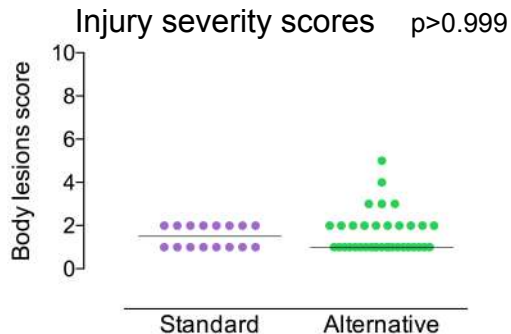
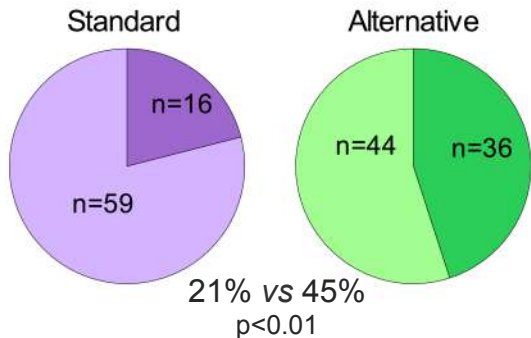


Similar performances in both groups

Effect of rearing conditions on aggressiveness

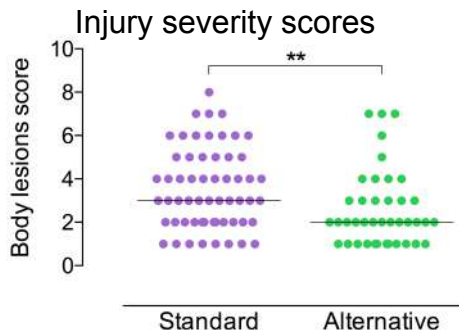
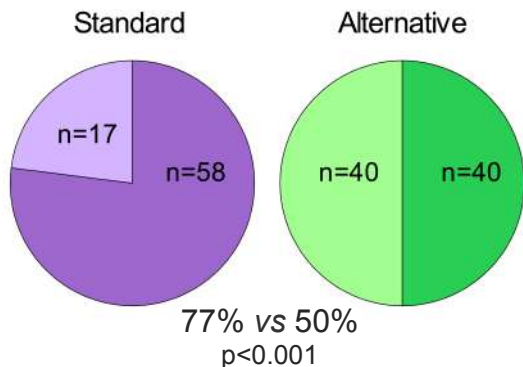
At day 10

Uninjured
Injured



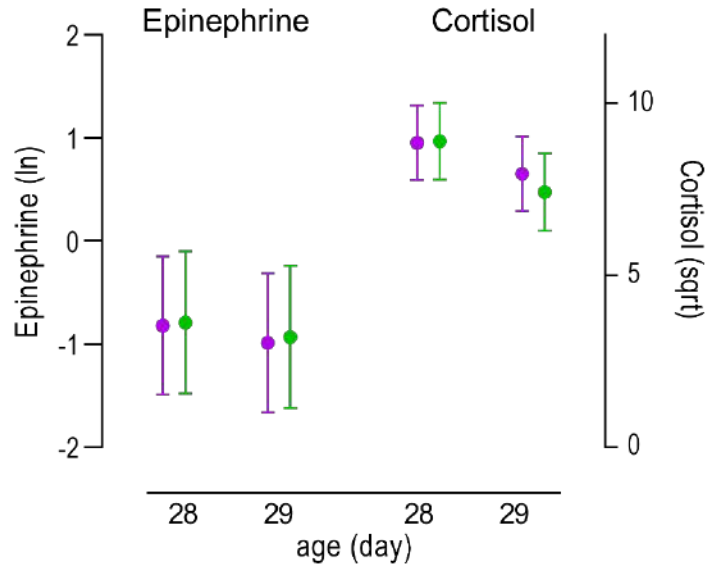
After 24 hours of socialization, piglets reared under alternative conditions showed more aggressiveness but the severity of injuries was low.

At day 29



24 hours after weaning, piglets reared under alternative conditions showed less aggressiveness.
⇒ Early-socialization better prepared piglets for weaning.

Effect of rearing conditions on stress mediators levels around weaning

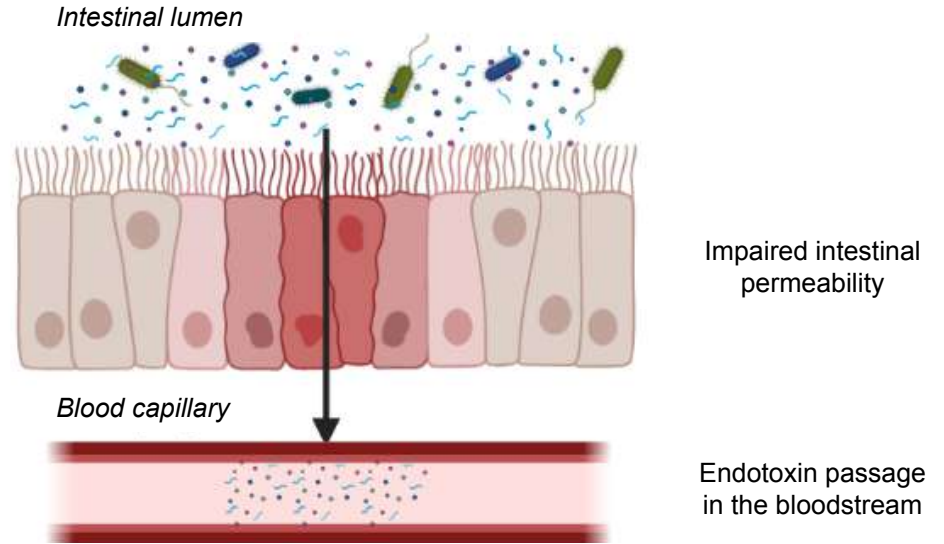
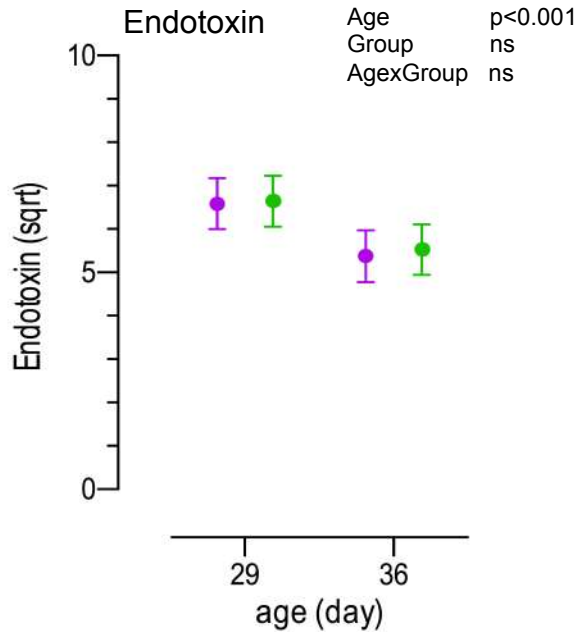


Circulating epinephrine and cortisol levels were not affected by rearing conditions.

Both were significantly higher just after weaning (d28) as compared to the day after (d29).

Epinephrine :		Cortisol :	
Age	p<0.01	Age	p<0.001
Group	ns	Group	ns
AgexGroup	ns	AgexGroup	ns

Effect of rearing conditions on intestinal barrier function

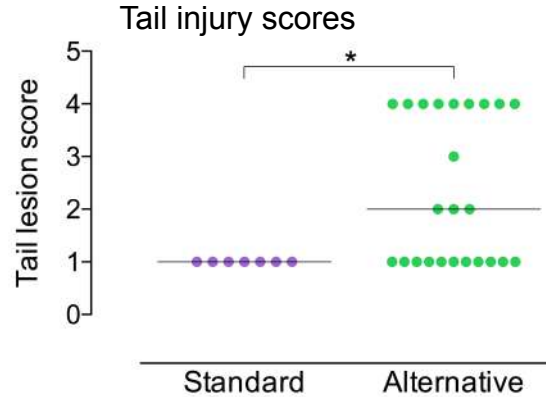
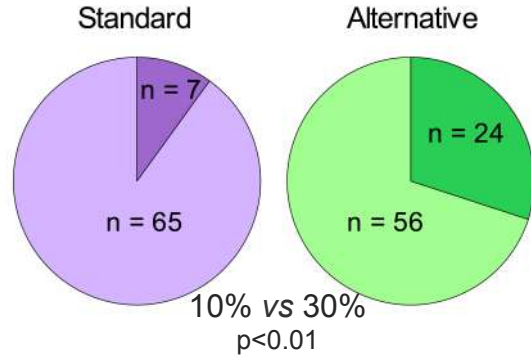


Circulating endotoxin levels were not affected by rearing conditions.

Circulating endotoxin levels were higher the day after weaning than a week later.

Effect of rearing conditions on tail-biting behaviour at d36

Uninjured
Injured

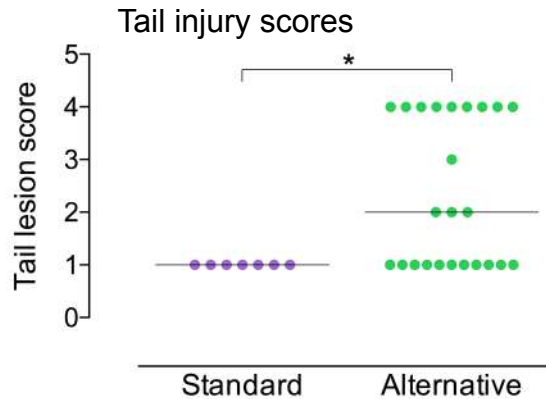
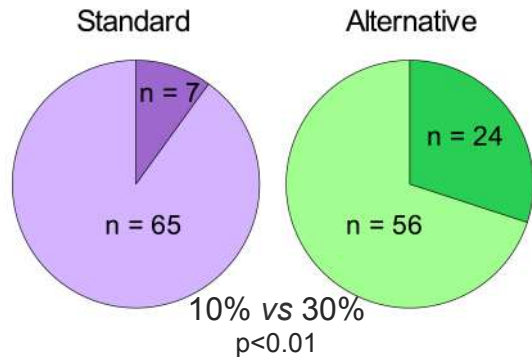


Tail-biting episodes started at d36 in both groups.

Piglets reared under alternative conditions were more injured and had more severe tail lesions.

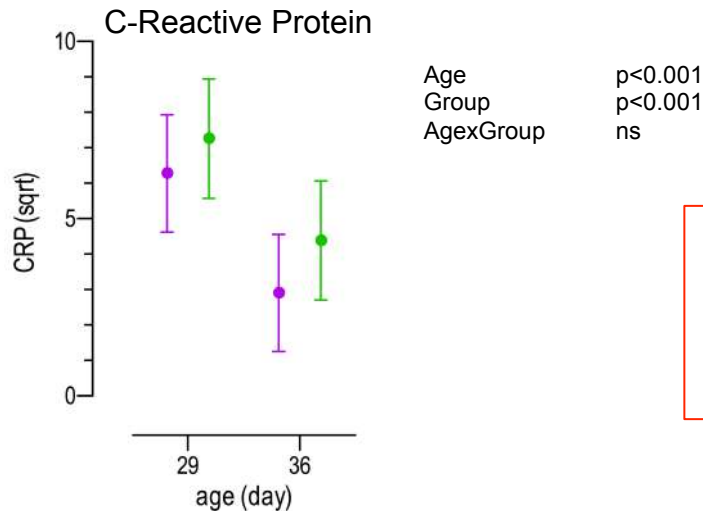
Effect of rearing conditions on tail-biting behaviour at d36

■ Uninjured
■ Injured



Tail-biting episodes started at d36 in both groups.

 Piglets reared under alternative conditions were more injured and had more severe tail lesions.

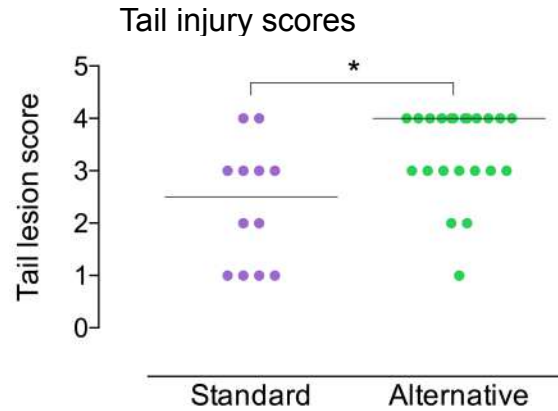
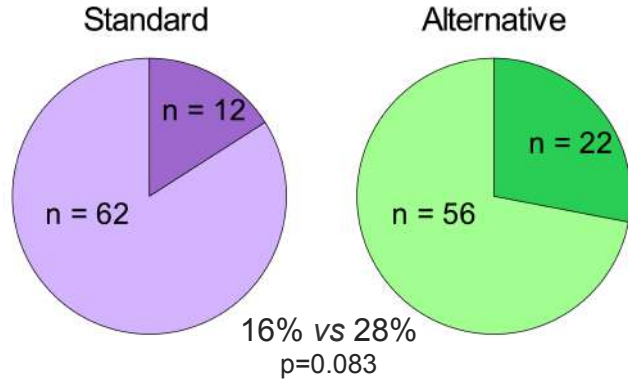


CRP levels were significantly higher at d29 than at d36 in both groups:
 ⇒ Inflammatory reaction due to vaccination.

Piglets in the alternative group had significantly higher CRP levels at d36:
 ⇒ Greater inflammation due to tail lesions.

Effect of rearing conditions on tail-biting behaviour at d66

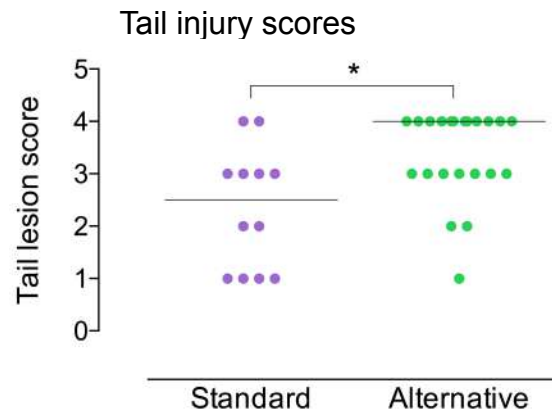
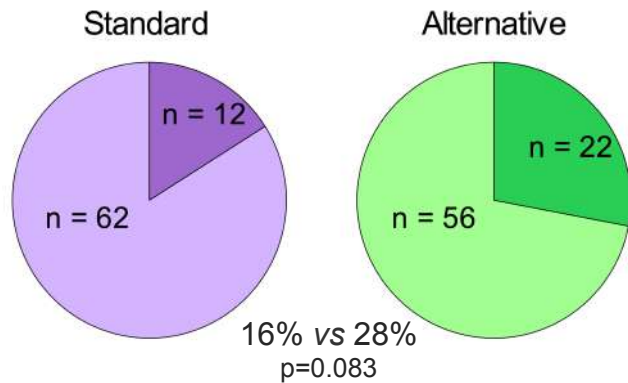
Uninjured
Injured



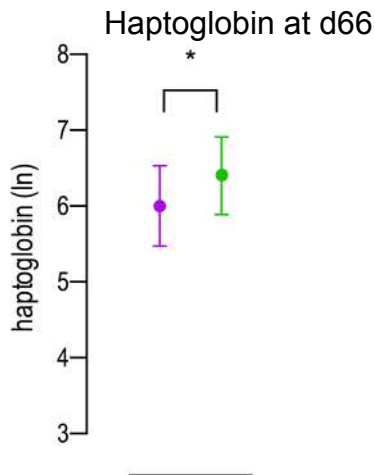
Tail injuries remained more severe in the alternative group during fattening.

Effect of rearing conditions on tail-biting behaviour at d66

Uninjured
Injured

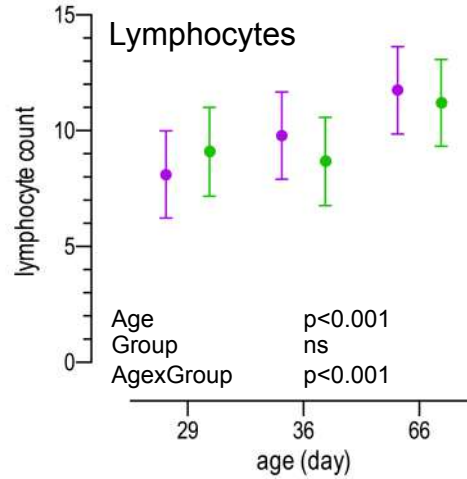
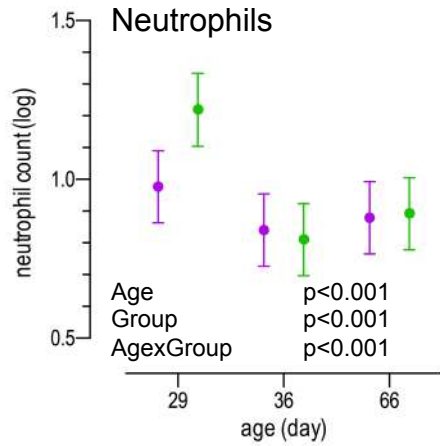


Tail injuries remained more severe in the alternative group during fattening.

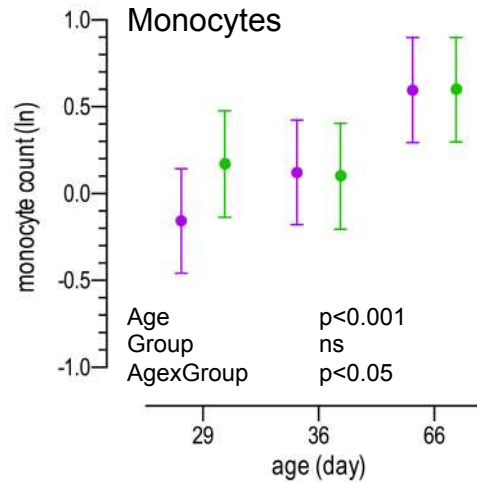
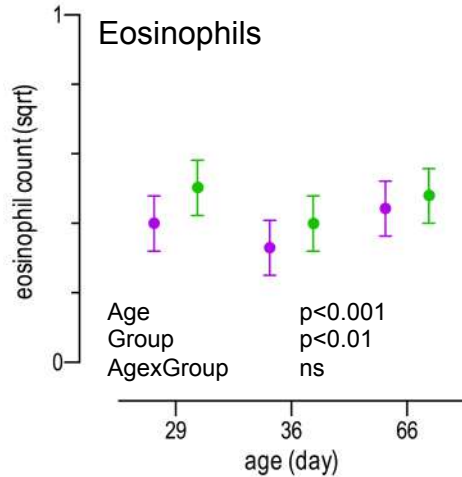


In agreement, haptoglobin concentration was significantly higher in piglets reared under alternative conditions:
⇒ Inflammation due to tail biting.

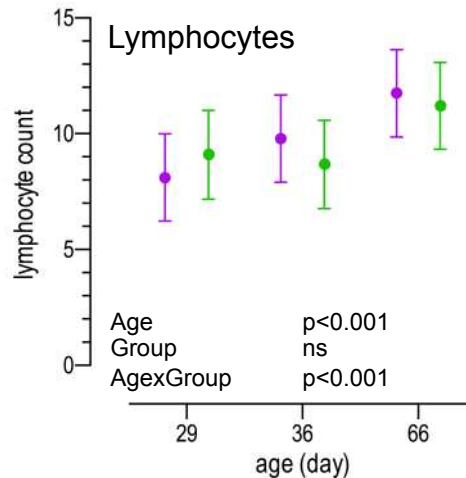
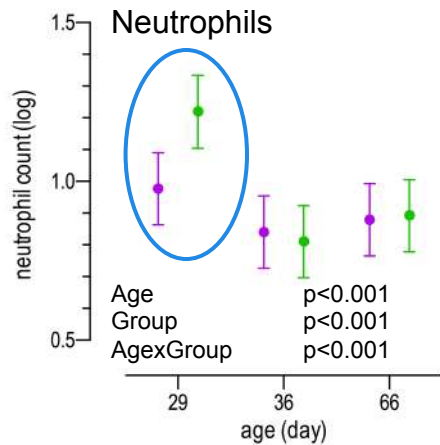
Effect of rearing conditions on immune cell counts



Numbers of neutrophils and eosinophils were greater at d29 than at d36 in both groups:
⇒ Vaccination effect.

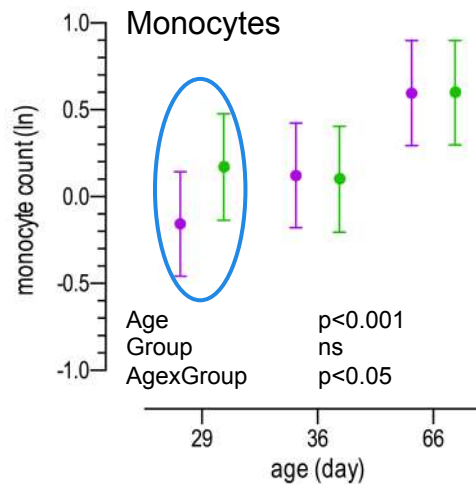
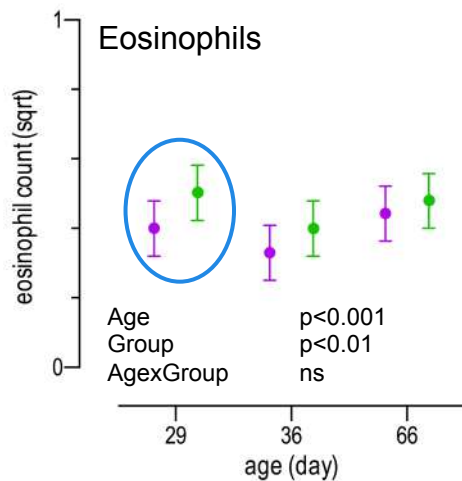


Effect of rearing conditions on immune cell counts

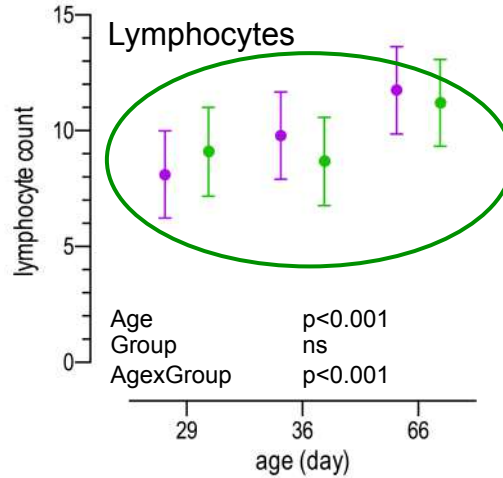
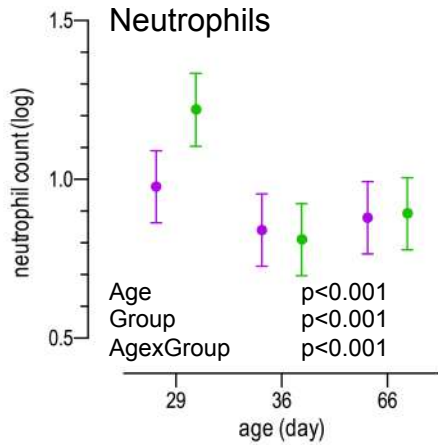


Numbers of neutrophils and eosinophils were greater at d29 than at d36 in both groups:
⇒ Vaccination effect.

Numbers of neutrophils, eosinophils and monocytes were significantly higher in alternatively-reared piglets at d29:
⇒ Early-socialization challenged piglets.

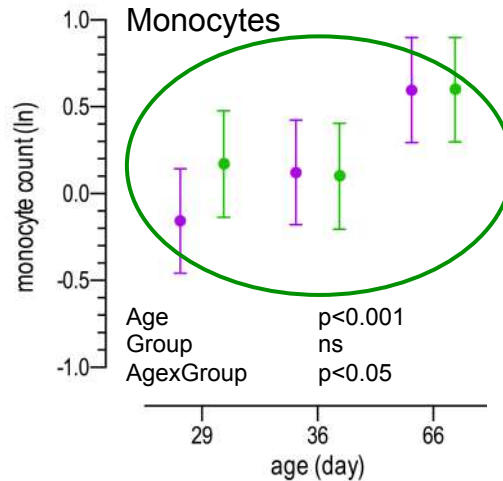
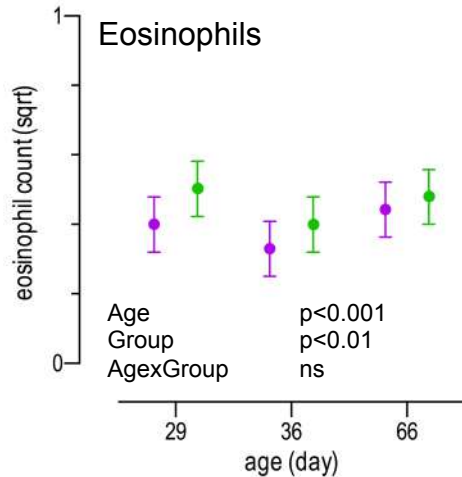


Effect of rearing conditions on immune cell counts



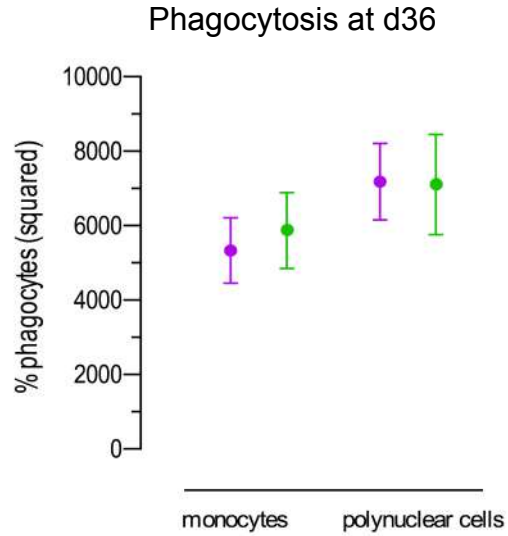
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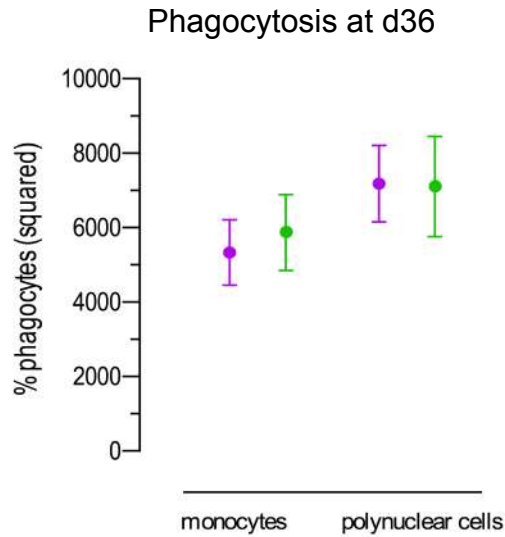
Numbers of lymphocytes and monocytes increased with age in piglets from both groups:
⇒ Early-socialization did not affected WBC counts in the long-term.

Effect of rearing conditions on immune cell competence

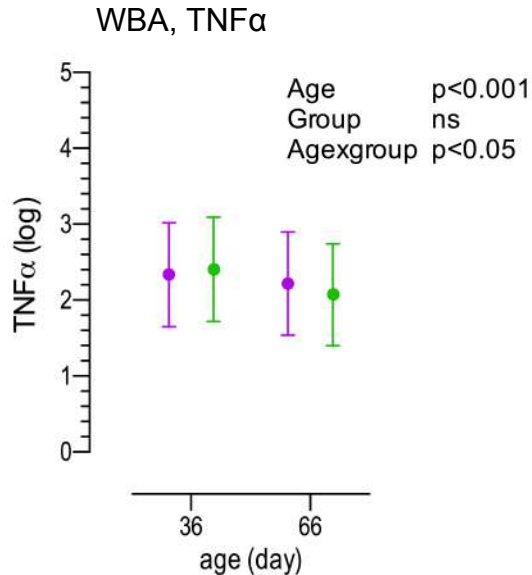


Phagocytosis capacity of monocytes and polynuclear cells at d36 was not influenced by rearing conditions.

Effect of rearing conditions on immune cell competence



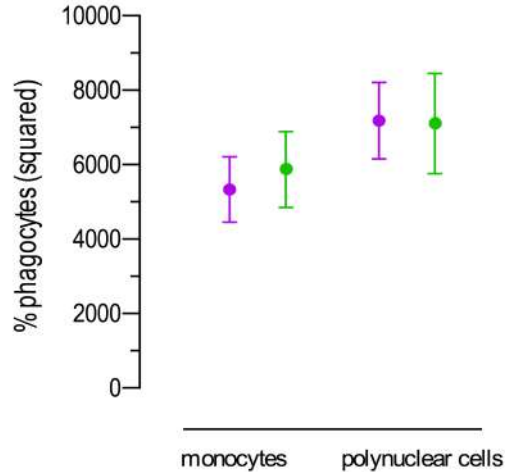
Phagocytosis capacity of monocytes and polynuclear cells at d36 was not influenced by rearing conditions.



The ability of blood cells to secrete TNF α in response to LPS decreased between d36 and d66 in both groups.

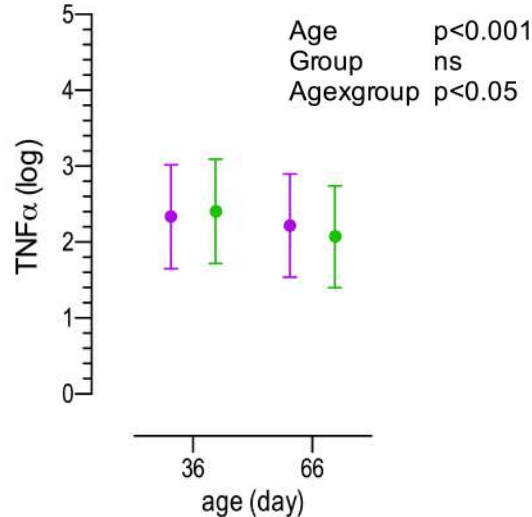
Effect of rearing conditions on immune cell competence

Phagocytosis at d36



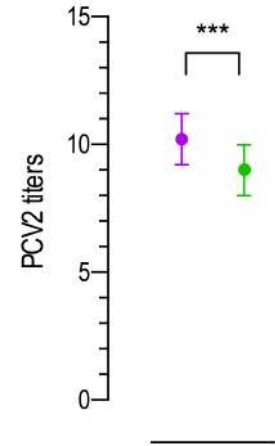
Phagocytosis capacity of monocytes and polynuclear cells at d36 was not influenced by rearing conditions.

WBA, TNF α



The ability of blood cells to secrete TNF α in response to LPS decreased between d36 and d66 in both groups.

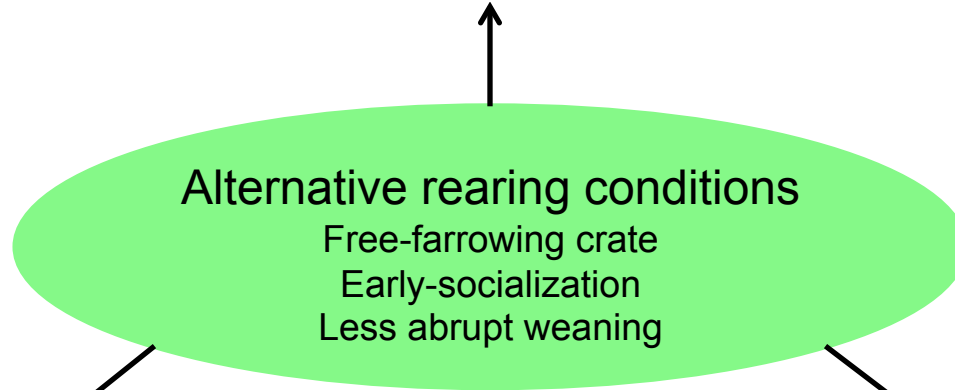
Anti-PCV2 vaccine response at d66



The level of anti-PCV2 antibodies was significantly lower in piglets reared under alternative conditions but all piglets were efficiently protected.

Conclusions

Slower growth during the lactation period
Better growth rate during the post-weaning period
⇒ **similar performances**

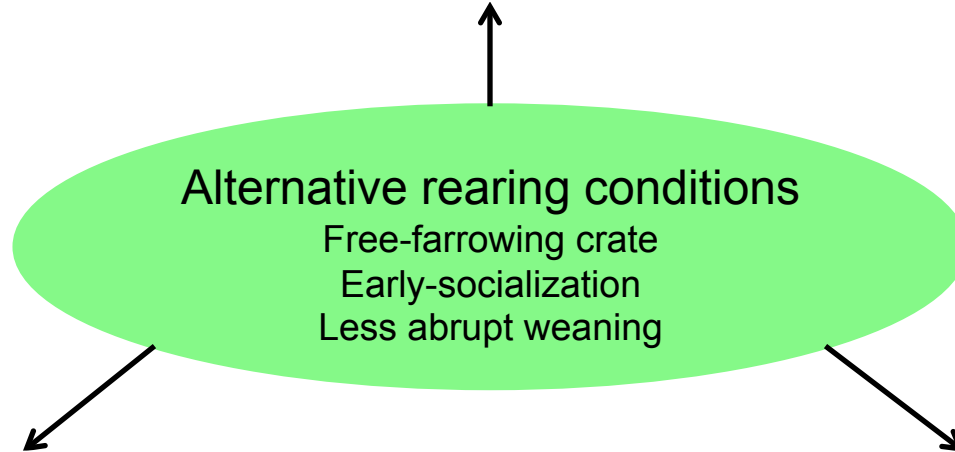


Good vaccine protection
Similar immune competence
⇒ **similar health status**

Fewer injuries the day after weaning
But episodes of tail biting
⇒ **cannibalism in undocked-tail piglets**

Conclusions

Slower growth during the lactation period
Better growth rate during the post-weaning period
⇒ **similar performances**



Good vaccine protection
Similar immune competence
⇒ **similar health status**

Fewer injuries the day after weaning
But episodes of tail biting
⇒ **cannibalism in undocked-tail piglets**

⇒ **Field studies are important to assess the transposability of alternative rearing practices and their true relevance to pigs' health and welfare**

Thank you for your attention



INRAE



Oniris
ÉCOLE NATIONALE
VÉTÉRINAIRE, AGROALIMENTAIRE ET DE L'ALIMENTATION
SANTÉ ET ALIMENTATION AU CŒUR DE LA VIE



BIOEPAR UMR 1300
INRAE, Oniris

METAPROGRAMME

SANTÉ et Bien-être des
Animaux en élevage
(MP-SANBA)



Région

PAYS DE LA LOIRE



Cooperl

GAEC du Pront



LIT
LABORATOIRE D'INNOVATION TERRITORIALE

QUEST TERRITOIRES
D'ÉLEVAGE



MSD
R&D service lab