

Impact of Deoxynivalenol (DON) in a Nutritional Calcium Depletion and Repletion Protocol in Piglets

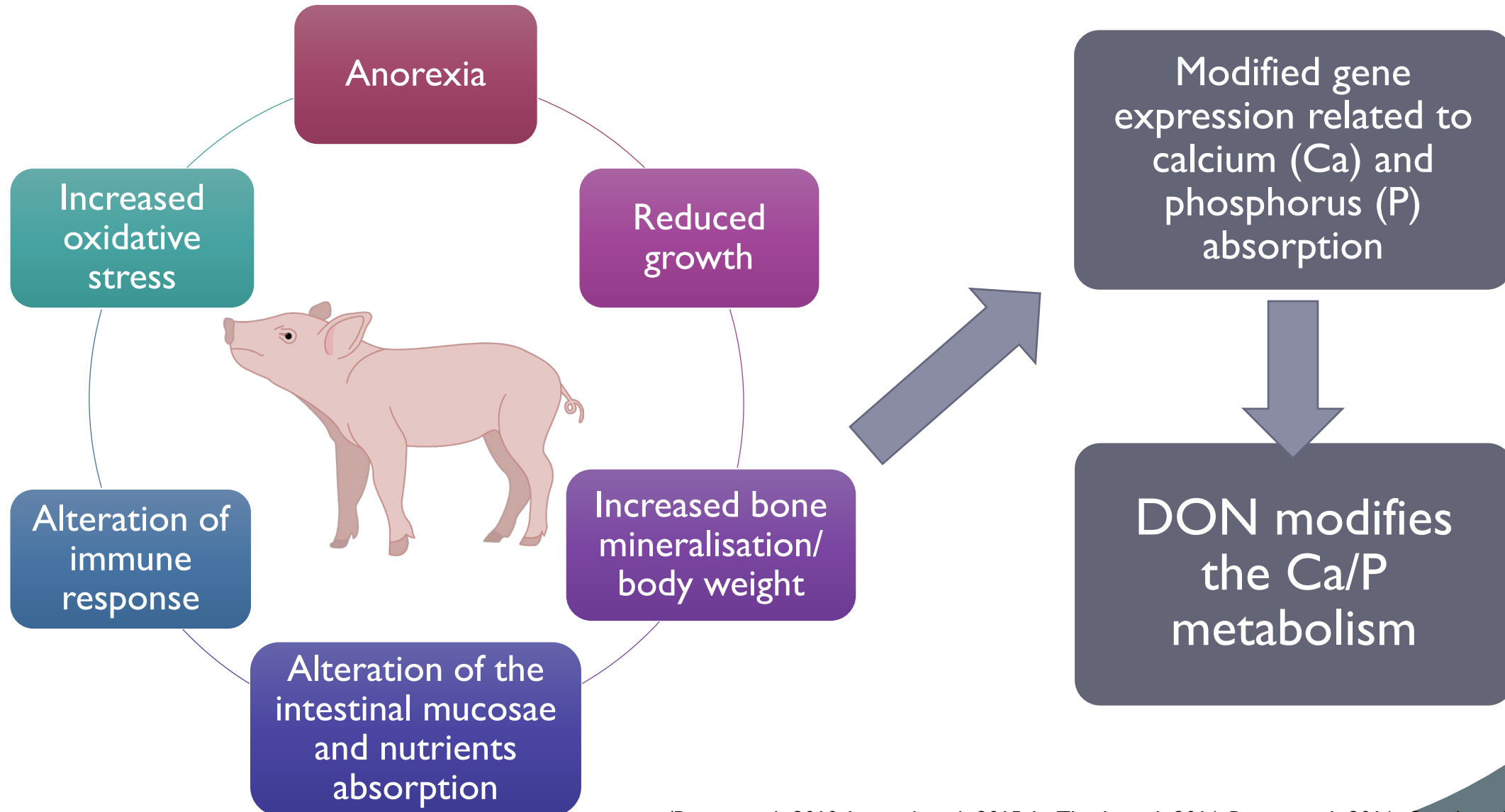
EAAP 2024, Florence, Italy

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The Impact of Deoxynivalenol (DON) on piglets



Does DON lead to hypercalcemia?



What about Ca and P digestibility?



Nutritional Ca depletion and repletion protocol

Ca deficiency



Leads to regulations

Intestinal
absorption

Bone
remodelling

Renal
reabsorption



Followed by a repletion phase in Ca

Better Ca and P utilization efficiency

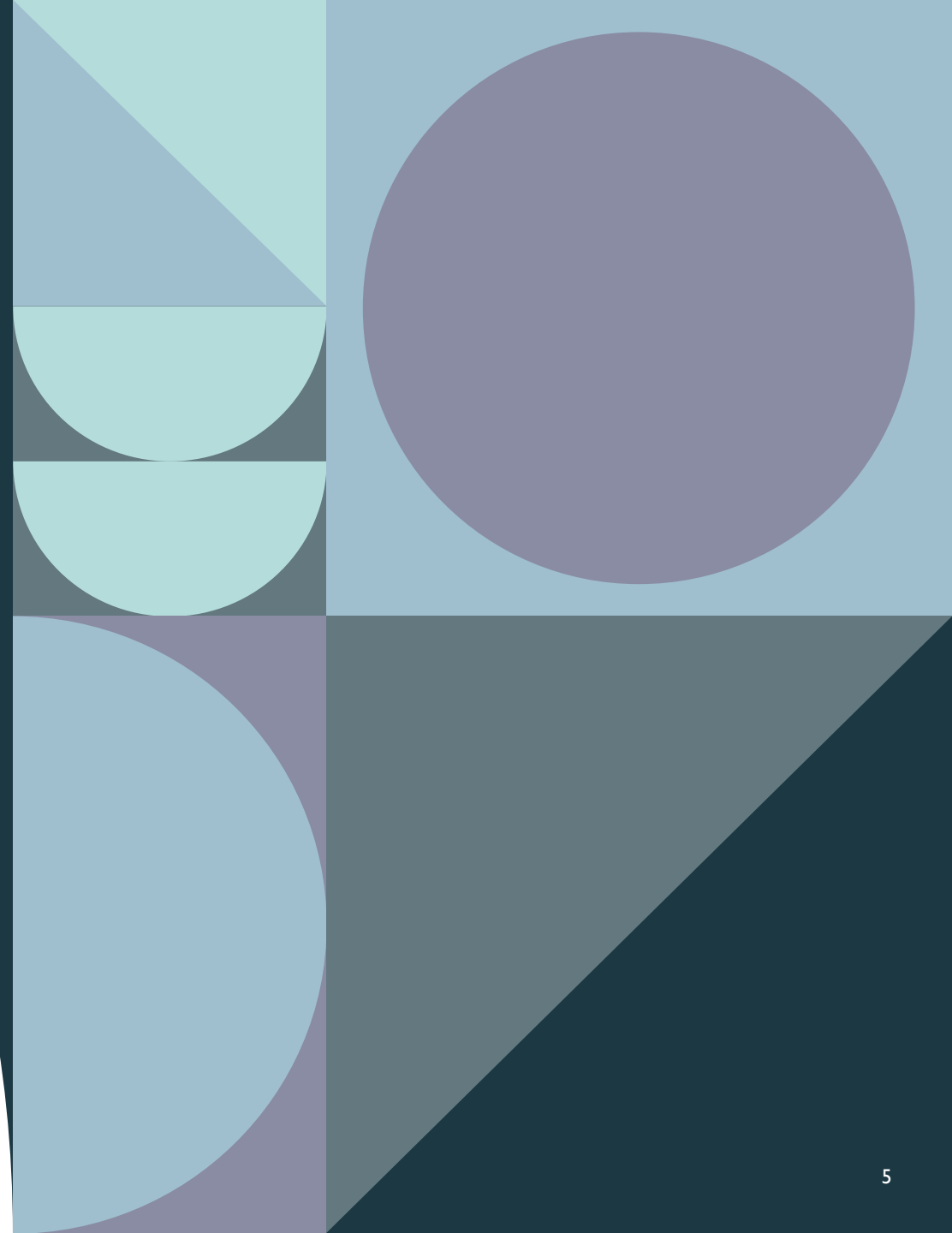
DON?

Objectives

- Understand the impact of DON on calcium metabolism by a Ca depletion-repletion strategy.
- Evaluate the impact of DON on the bone metabolism and Ca and P digestibility.



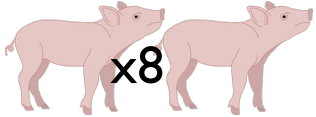
Materials and Methods



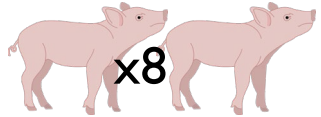
Experimental treatments

x64

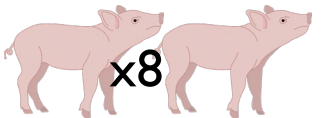
Phase I, digestible P: 0.40%



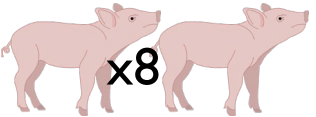
1. Ca+: 0.65%



2. Ca+DON+: 0.65%; 2.92 mg/kg



3. Ca-: 0.39%



4. Ca-DON+: 0.39%; 2.52 mg/kg

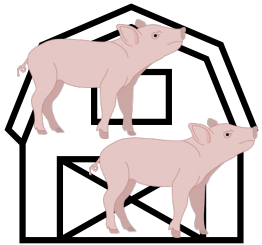
Phase 2, digestible P: 0.35%

Ca+: 0.65%

Piglets for gene expression

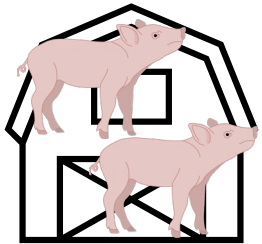
Digestible P : 0,40%

x4



1. DON-: total Ca 0.65%

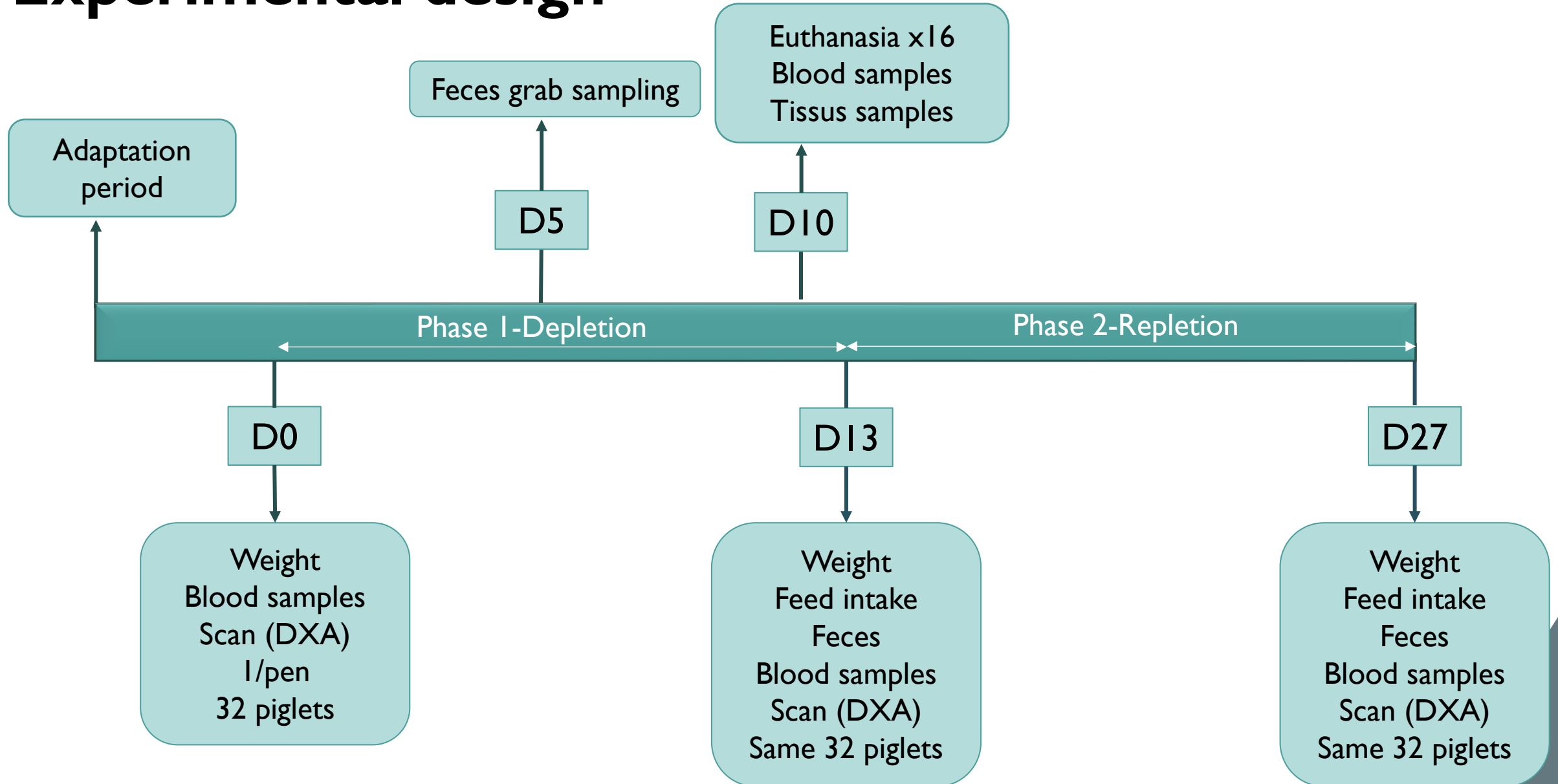
x4



2. DON+: total Ca 0.65%; 2.92 mg/kg

Euthanized after 10 days
of depletion phase

Experimental design



Sample analysis

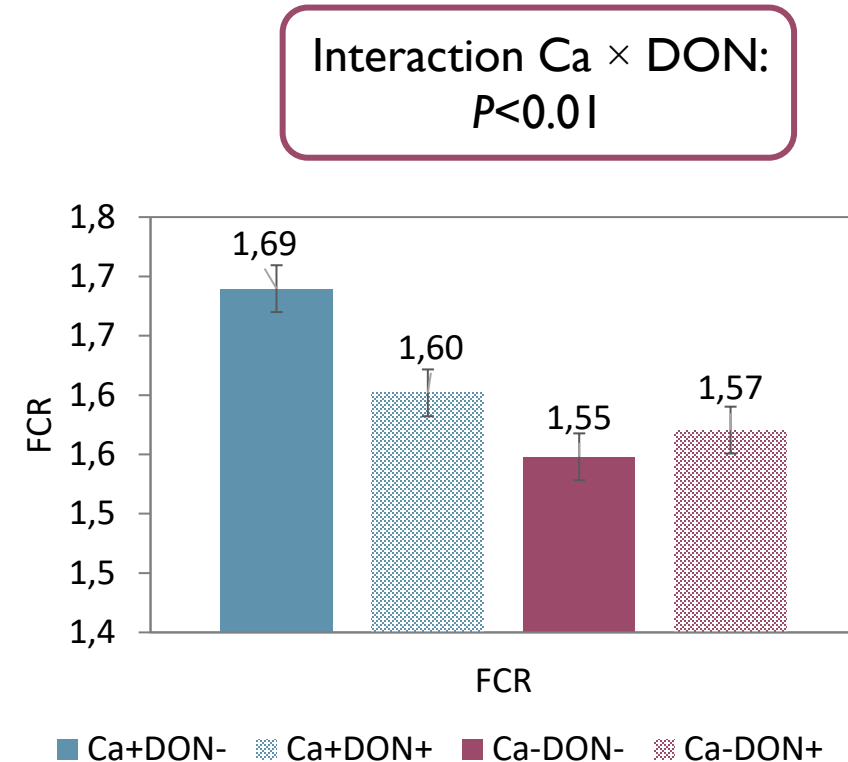
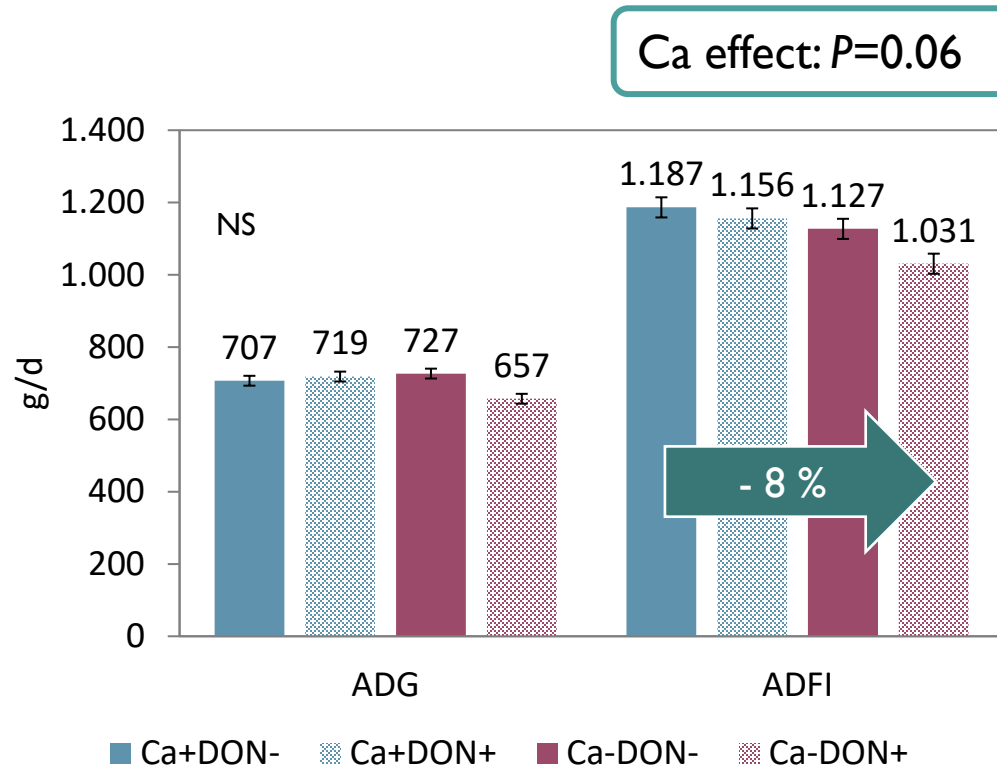
- Bone mineral content (BMC):
Dual-Intensity X-Ray Absorptiometry (DXA) on the same pig
- Apparent total tract digestibility (ATTD)
Indigestible marker (insoluble ash)
- 16 piglets euthanized:
Gene expression analysis in the kidney, liver, jejunum, and cortical and trabecular femur
- Statistical analysis
Mixed model ANOVA with a factorial design 2 x 2 (Ca x DON)



Results and Discussion

Depletion Phase

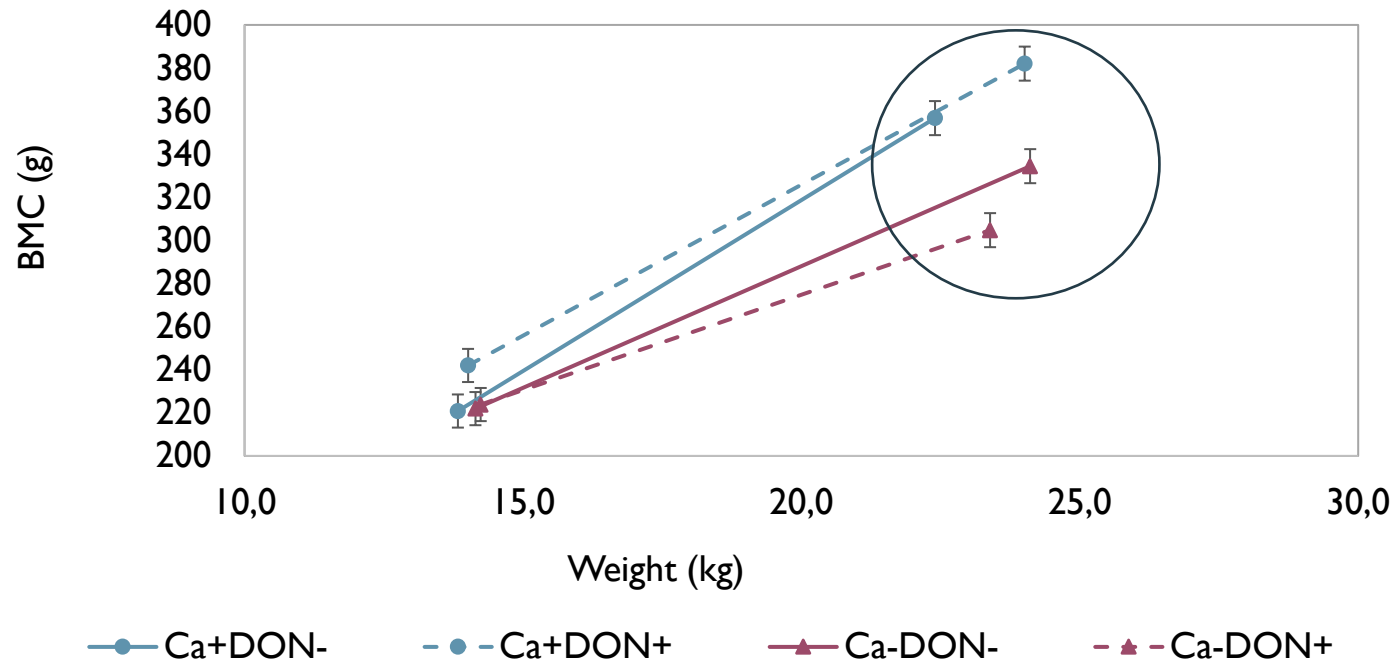
Growth performances



Feed conversion ratio (FCR) decreased by Ca-, especially for Ca-DON-

No DON effect on growth performances.

Bone Mineralisation



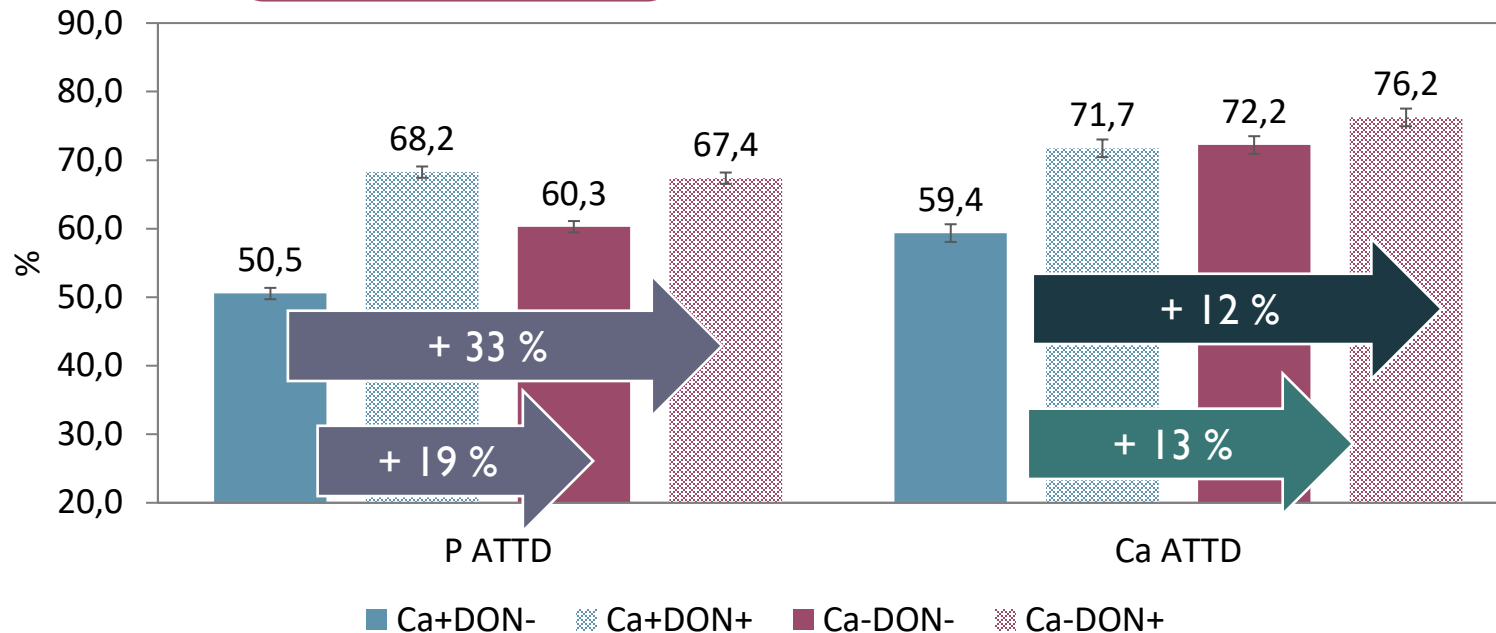
BMC gain
Ca $\times$ DON interaction :
 $P < 0.05$

BMC gain is more decreased by Ca-DON+.

Ca and P Digestibility

After 5 days

Ca × DON
Interaction : $P < 0.05$



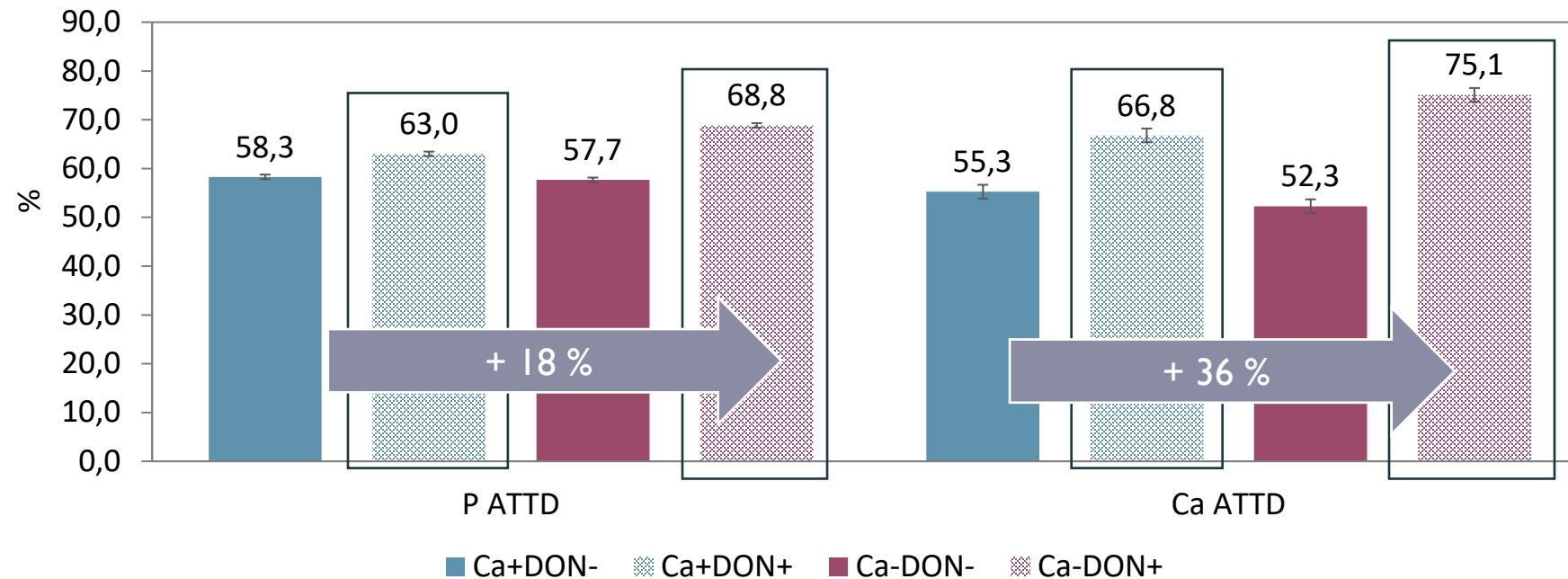
DON and Ca- increase the Ca and P digestibility

Ca and P Digestibility

After 13 days

Ca × DON:
Interaction $P < 0.01$

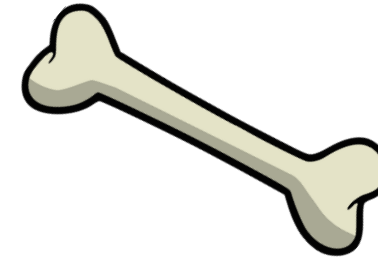
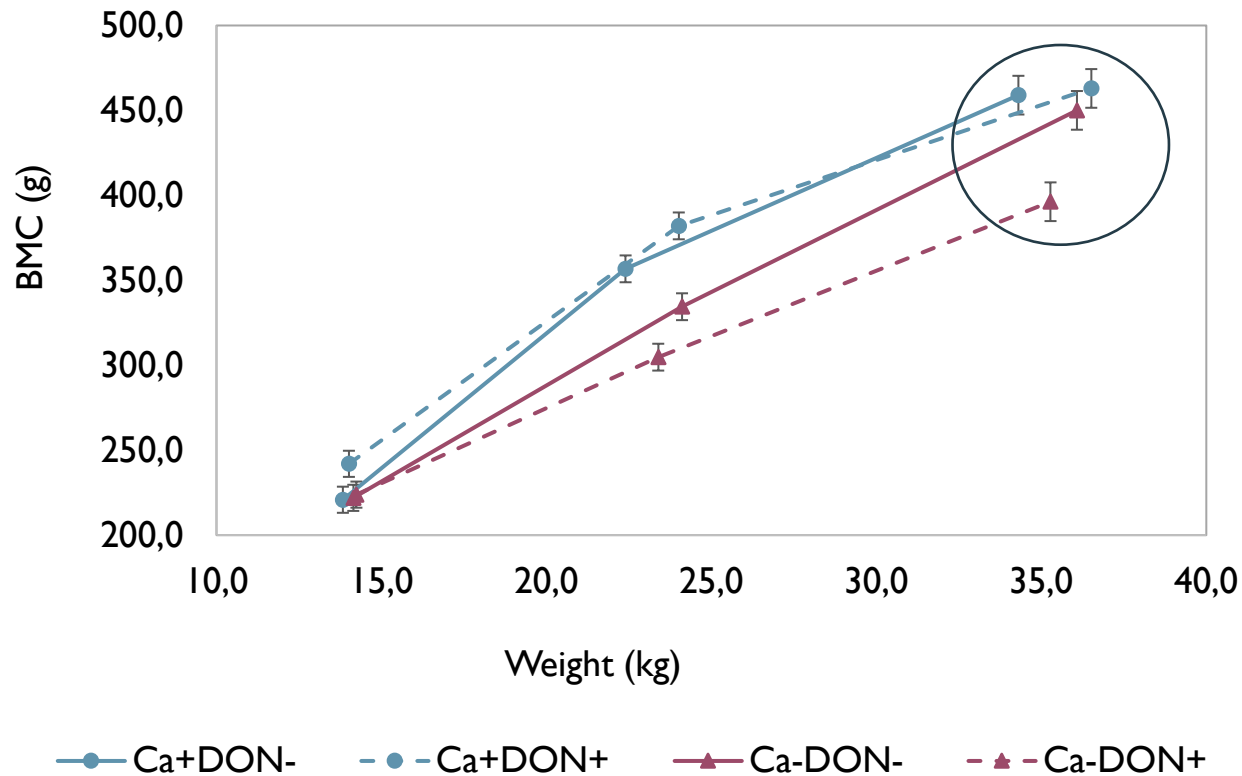
Ca × DON
Interaction: $P = 0.08$



Only DON continues to increase the Ca and P digestibility after 13 days. Rapid response to the Ca deficiency, but only temporary.

Repletion Phase

Bone Mineralisation

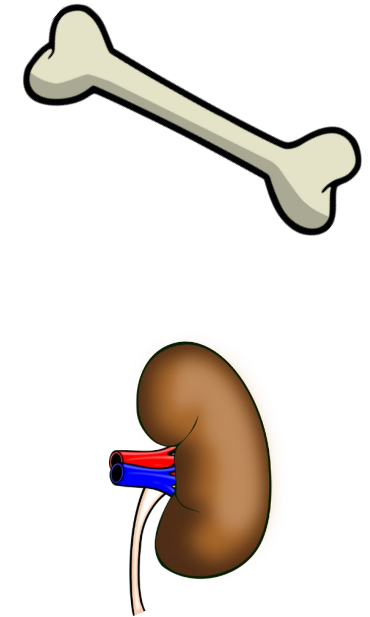
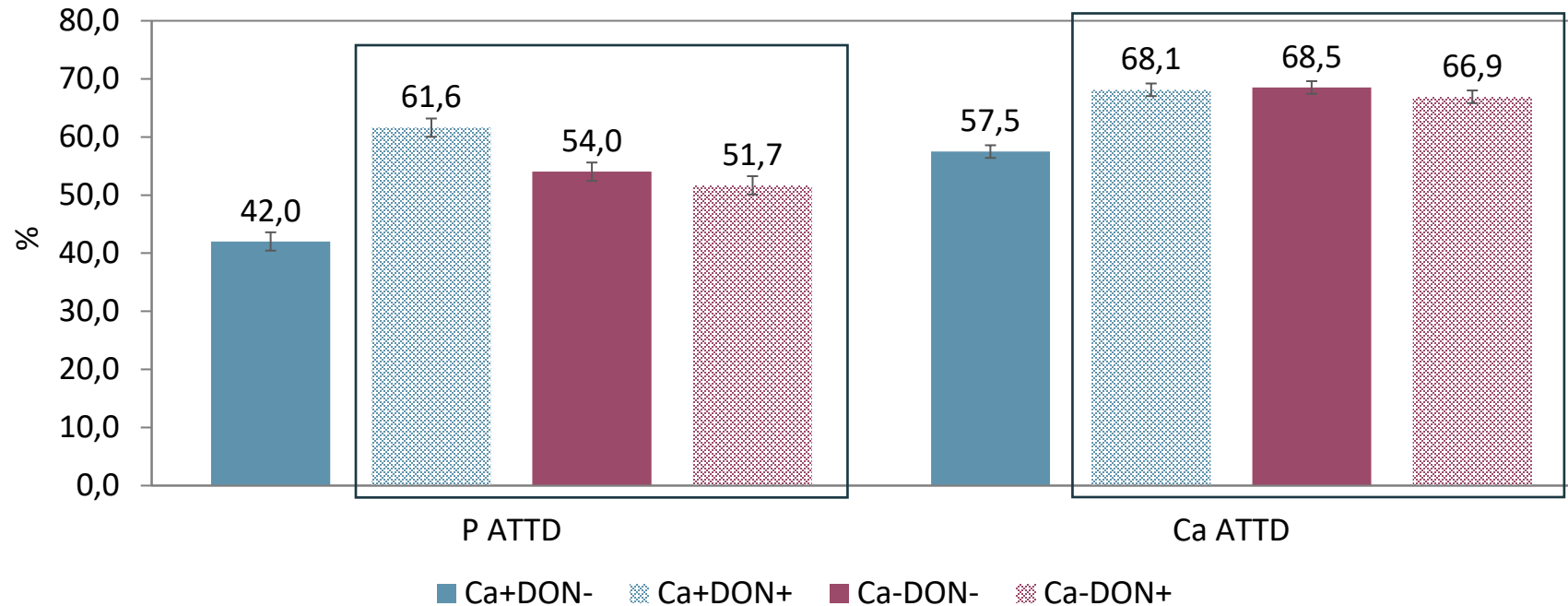


BMC of Ca-DON+ piglets remained lower
(Ca $\times$ DON Interaction; $P = 0.06$)

Piglets that experienced a Ca deficiency without DON increased their BMC gain, compensating for their bone mineralisation deficit to reach the Ca+ piglets (8,34 g/d vs 7,30 g/d).

Ca and P Digestibility

Ca × DON Interaction : $P < 0.05$

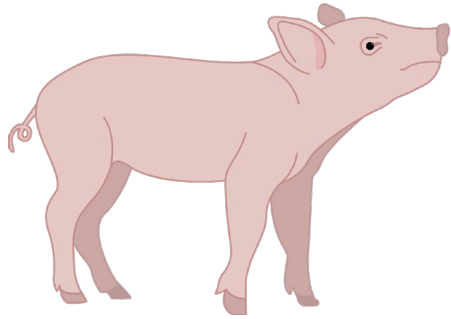


Piglets that received DON or a Ca deficiency increased their Ca and P digestive utilization efficiency. However, Ca-DON+ piglets have a lower bone mineralisation...



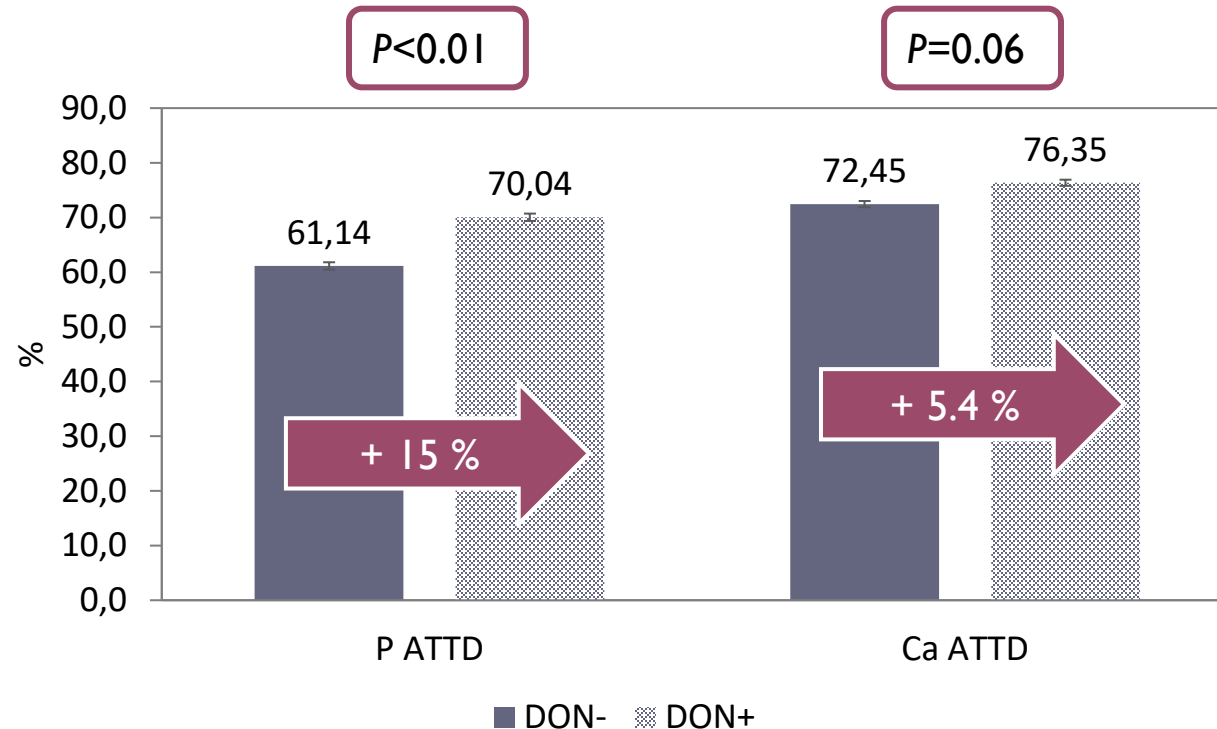
DON Results after 10 Days

Growth Performance and Digestibility



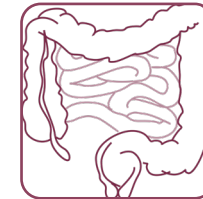
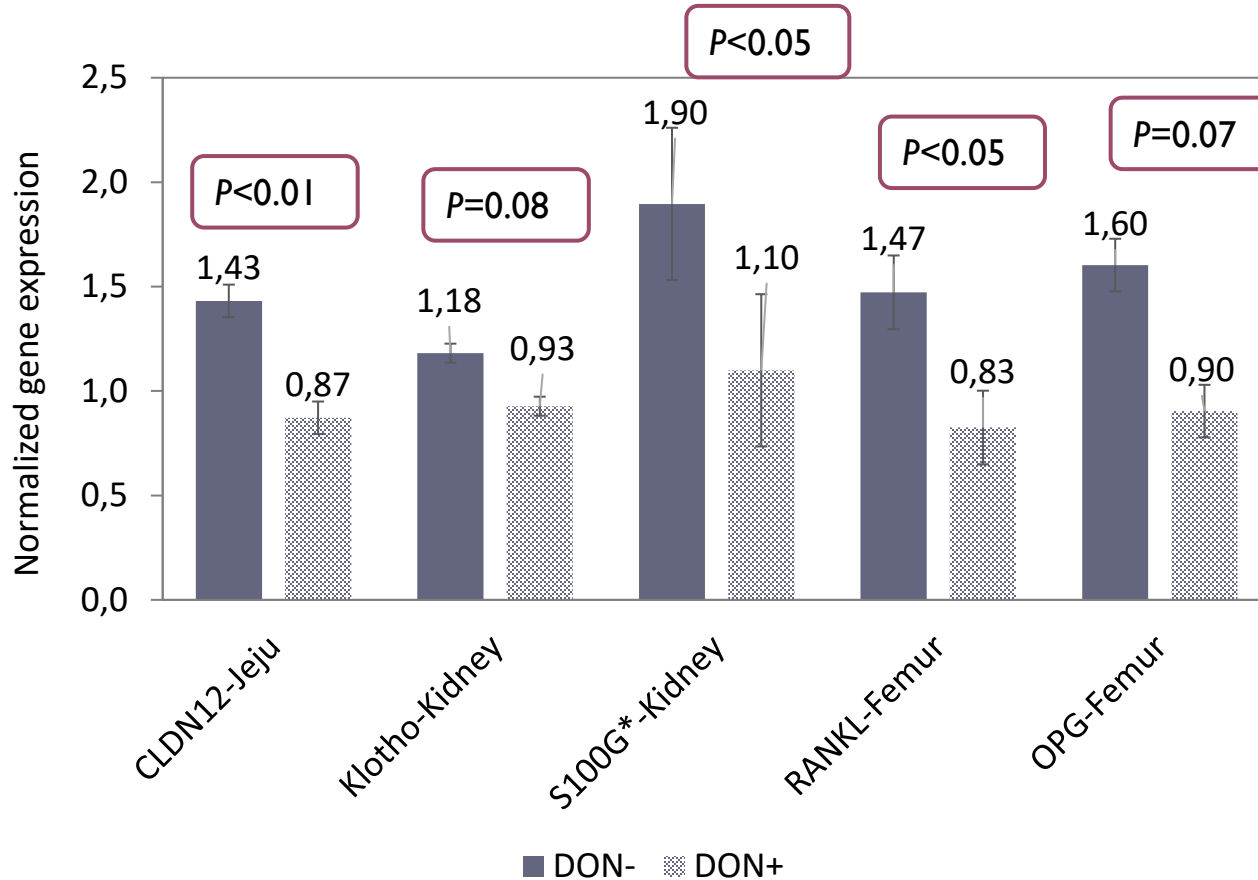
No effect on growth

No effect on feed intake

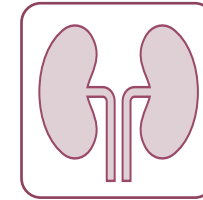


DON still increases the Ca and P digestibility

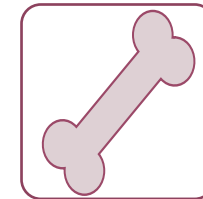
Gene Expression



Claudin 12: Ca paracellular absorption



Klotho: FGF23 coreceptor
S100G: Renal Ca transport



RANKL binds to the RANK receptor, and **OPG** (osteoprotegerin) binds to RANKL in osteoclast metabolism

Conclusion

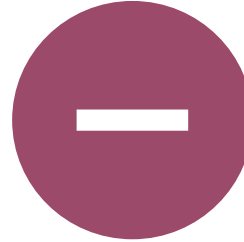
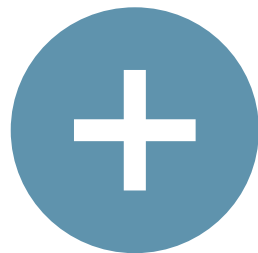


Depletion

- Ca deficiency rapidly increased the Ca and P digestibility after 5 days, but temporarily, with a decrease after 13 days.
- DON increased the Ca and P digestibility after 5 and 13 days.

Repletion

- The increased Ca and P digestibility allowed the Ca-DON- piglets to cope for their bone mineralisation deficit from the depletion phase.

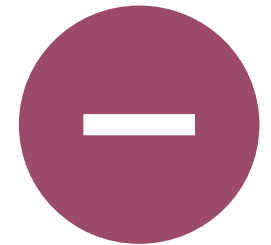


Depletion

- Bone mineralisation is more reduced for Ca-DON+.
- =Alteration of renal reabsorption and/or decrease in bone accretion?
- Downregulation of RANKL and OPG gene expression by DON in bone...

Repletion

- The Ca-DON+ piglets did not cope their BMC deficit, despite an increase in Ca and P digestibility.
- DON decreases bone gain.
- **Long-term effect on bone mineralisation.**



Any questions?

Thank you!

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PROGRAMME

INNOV' ACTION

AGROALIMENTAIRE

