

Nursery pigs kept in poor sanitary housing conditions benefit from diets with low buffer capacity

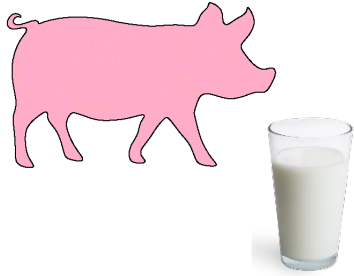
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Introduction – problem statement



Weaning (3–4 weeks of age)



Rennin / chymosin: milk clotting → digestion milk proteins

- Optimum pH 5.3–6.0

“Acidification” via lactic acid from sow milk lactose and Lactobacilli

- Inhibits HCl production (Cranwell et al., 1976)
- Milk components are buffering any intrinsically secreted HCl (Manners, 1976)

Pepsin: enzymatic digestion → digestion vegetable proteins

- Optimum pH 2.5–3.5

Acidification via hydrochloric acid (HCL)

- HCl production optimal ~8–10 weeks of age (Manners, 1976)
- pH stays ~4.5 up to 4 hours after meal (TN R&D internal results)
- Pathogens survive at pH 4–8 (Knarreborg et al., 2001 and 2002)

Options to improve stomach function?

- Influence passage rate (e.g., Bornhorst et al., 2013; Nadia et al., 2022; Lannuzel, 2024)
- Dietary buffer capacity

Introduction – dietary buffer capacity

Dietary buffer capacity = capacity of a feed material to bind acid (HCl) until a pH of 4 is reached (Lawlor et al., 2005)

- Higher values → more resistance to pH change → higher need for intrinsically secreted HCl

Nursery pigs may benefit from diets with lower buffer capacity

- Improved growth performance (Gutierrez et al., 2023; Stas et al., 2023)
- Too high inclusion of acidifiers impacts feed intake (Gutierrez et al., 2023)

Hypothesized to be especially important in poor sanitary housing conditions



Research objective

To determine the dose-response relation between dietary buffer capacity and growth performance of nursery pigs kept in poor sanitary housing conditions

Hypothesis

- Lower buffer capacity better growth and fecal scores

Materials and methods – poor sanitary housing conditions model

Specialized nursery barn with elevated pens

Subclinical housing conditions

- Spread ~1.5 kg nursery manure on 4 occasions (weaning day, d4, 7 and 12 post-weaning) on partially closed floor
- Reduce standard temperature setting with 2°C
- No floor heating directly below pens



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Materials and methods – animals and dietary treatments

80 pens and 240 pigs in total

- 2 departments with poor sanitary housing conditions with 40 pens each
- 20 pens per dietary treatment with 3 pigs each

Randomized complete block design with body weight at weaning as blocking factor

- Entire males and females separated
- Weaned at 23 (± 1) days of age and 6.8 (± 1.3) kg body weight

4 dietary treatments

- Wheat-barley based diets (16% CP; NE 2500 kCal/kg)
- Different dietary buffer capacities by changing Ca source and acidifiers*

Treatment	Dietary buffer capacity d0–14	Dietary buffer capacity d14–38
1	290 mEq/kg	550 mEq/kg
2	370 mEq/kg	
3	450 mEq/kg	
4	530 mEq/kg	

Materials and methods – measurements and data analyses

Body weight at weaning (d0), day 14 and 38

Average daily gain and feed intake (g/pig/d) d0-14, d14-38, and d0-38

Daily fecal scores recalculated to incidences per period

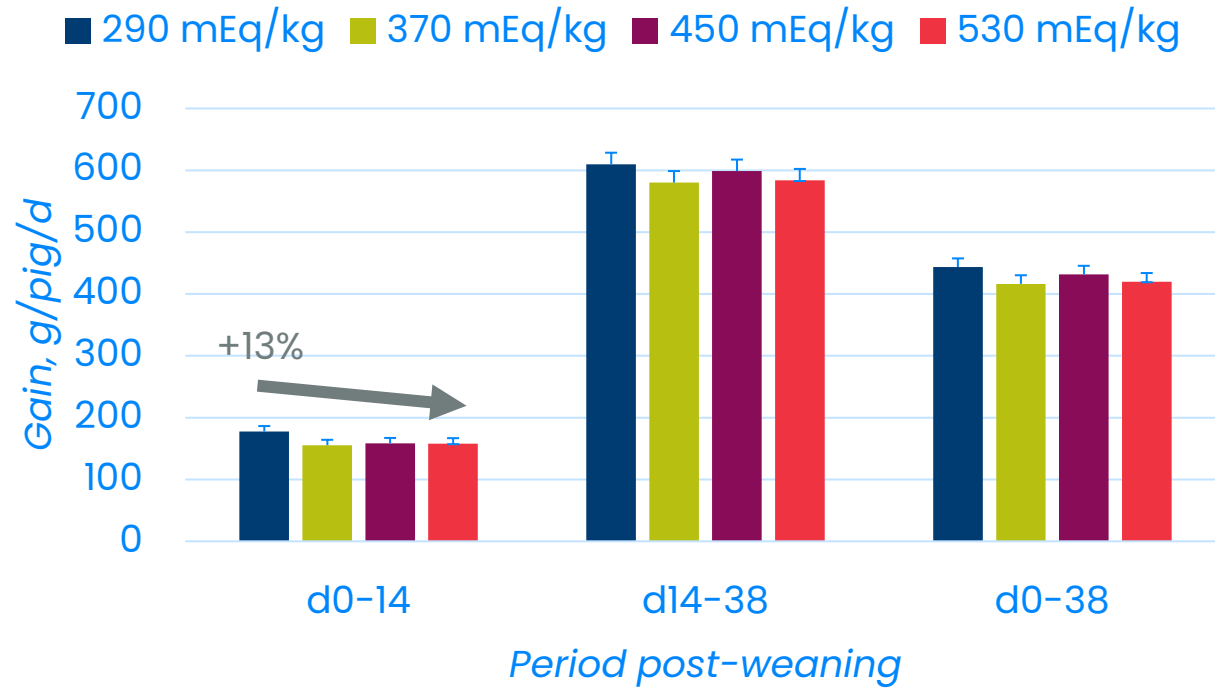
- Fecal score ≥ 1 (loose feces + diarrhea)

PROC MIXED or GLIMMIX with treatment as fixed effect and weaning BW block as random effect

- Polynomial orthogonal contrasts for linear and quadratic effects

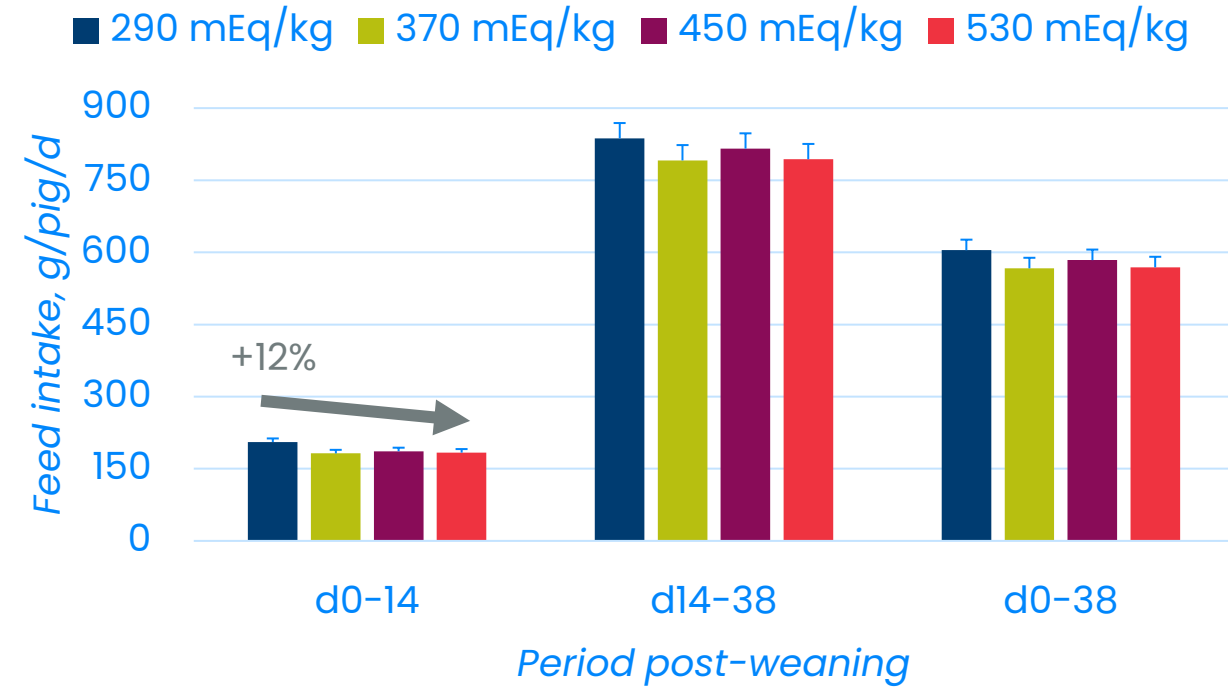
Results – Body weight gain and feed intake

Buffer capacity vs average daily gain



P-values	D0-14	D14-38	D0-38
Model	0.125	0.308	0.165
Linear	0.092	0.284	0.187
Quadratic	0.138	0.561	0.408

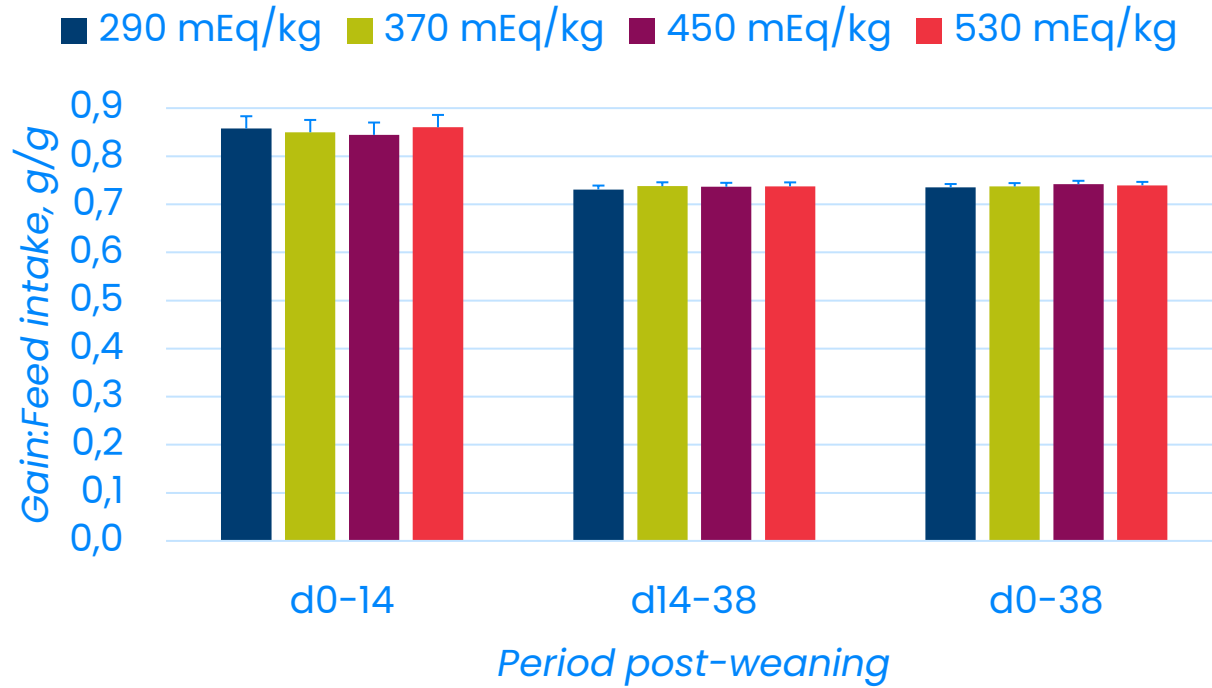
Buffer capacity vs average daily feed intake



P-values	D0-14	D14-38	D0-38
Model	0.060	0.262	0.171
Linear	0.047	0.203	0.135
Quadratic	0.132	0.520	0.395

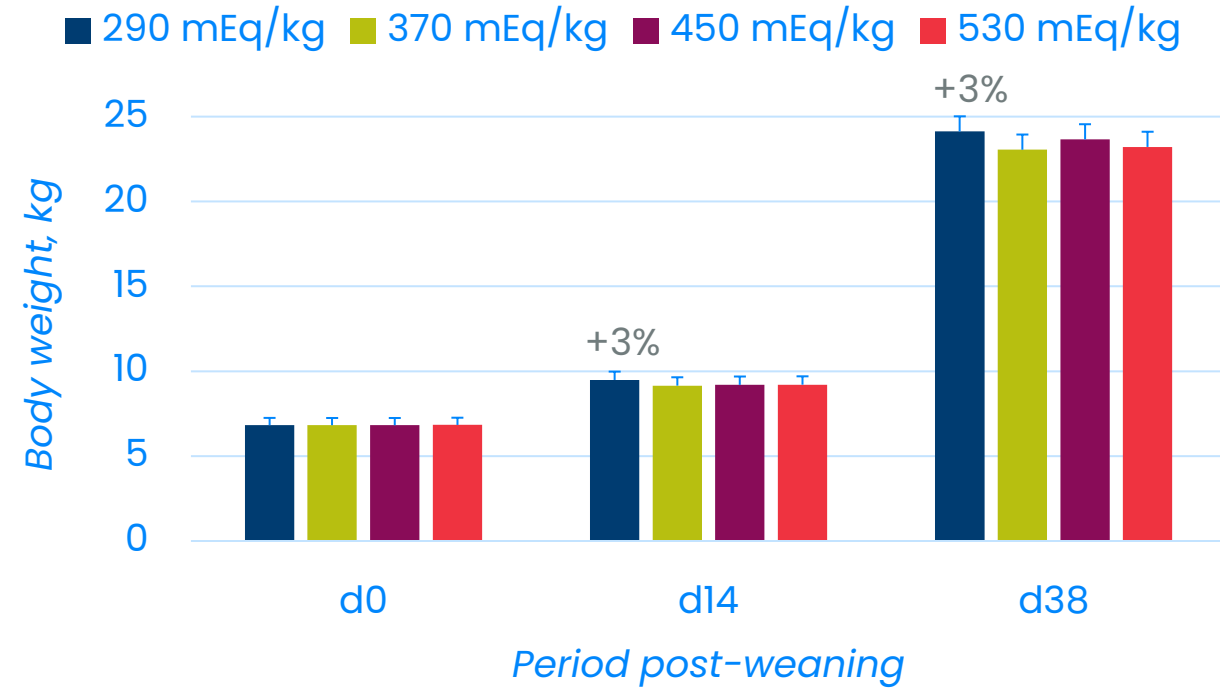
Results – Feed efficiency and body weight

Buffer capacity vs feed efficiency



P-values	D0-14	D14-38	D0-38
Model	0.939	0.811	0.810
Linear	0.977	0.462	0.438
Quadratic	0.552	0.610	0.687

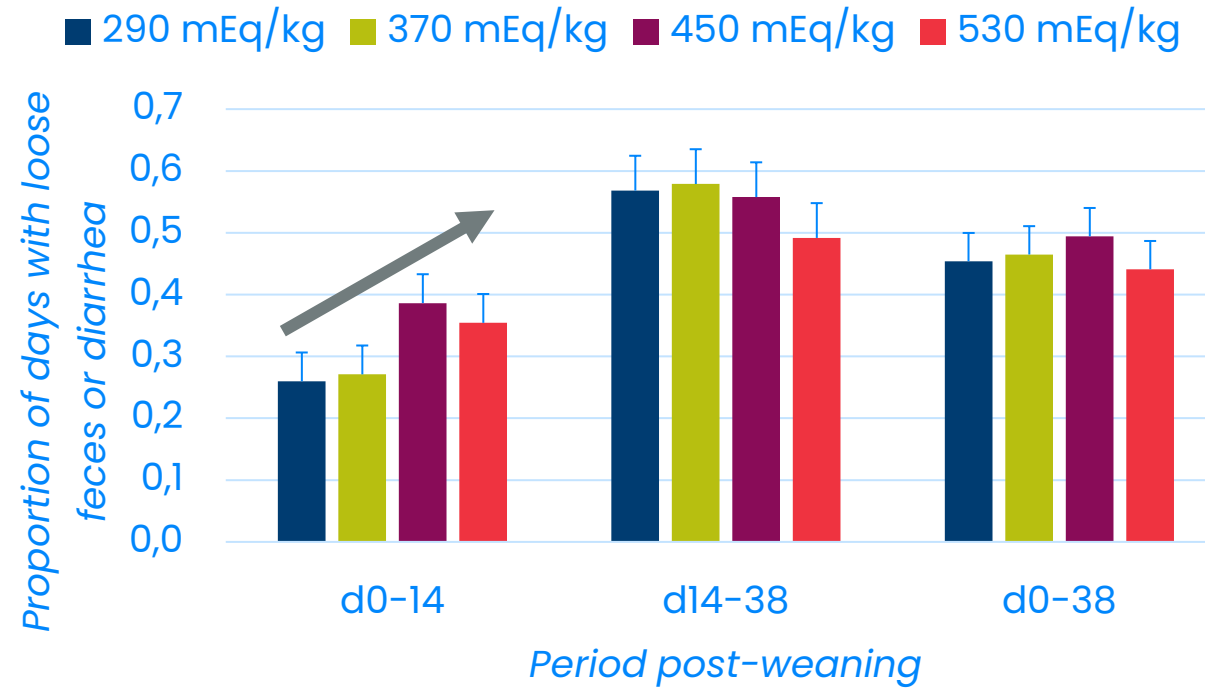
Buffer capacity effect vs body weight



P-values	D0	D14	D38
Model	0.918	0.104	0.159
Linear	0.685	0.095	0.194
Quadratic	0.574	0.101	0.386

Results – Fecal score

Buffer capacity vs fecal score ≥ 1



P-values	D0-14	D14-38	D0-38
Model	0.114	0.562	0.800
Linear	0.043	0.241	0.955
Quadratic	0.629	0.422	0.416

Conclusion

Linear relation dietary buffer capacity and average daily gain and feed intake during d0-14

- 290 mEq/kg higher compared to rest
- Through improved gastrointestinal health
 - Best fecal scores with 290 mEq/kg

Little effect after transition to common diet (d14-38)

But carry-over effect towards a 3% higher end body weight ($P_{\text{model}}=0.16$)

Diets with lower buffer capacity beneficial for nursery pigs kept in poor sanitary housing conditions

A photograph of several pigs in a facility, possibly a laboratory or processing plant. The pigs are standing on a metal grate floor. One pig in the center is looking directly at the camera. The image has a blue and yellow color overlay. A large yellow curved shape is at the bottom left, and a blue curved shape is at the bottom right.

Thank you for listening