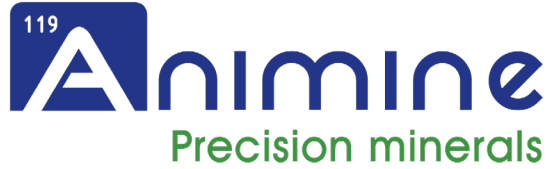
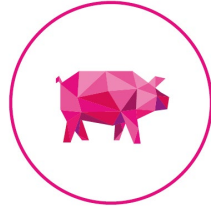


Abstract #2211875



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# The combination of an alternative zinc source and low ABC-4 diets can replace the high levels of ZnO in nursery piglet diets

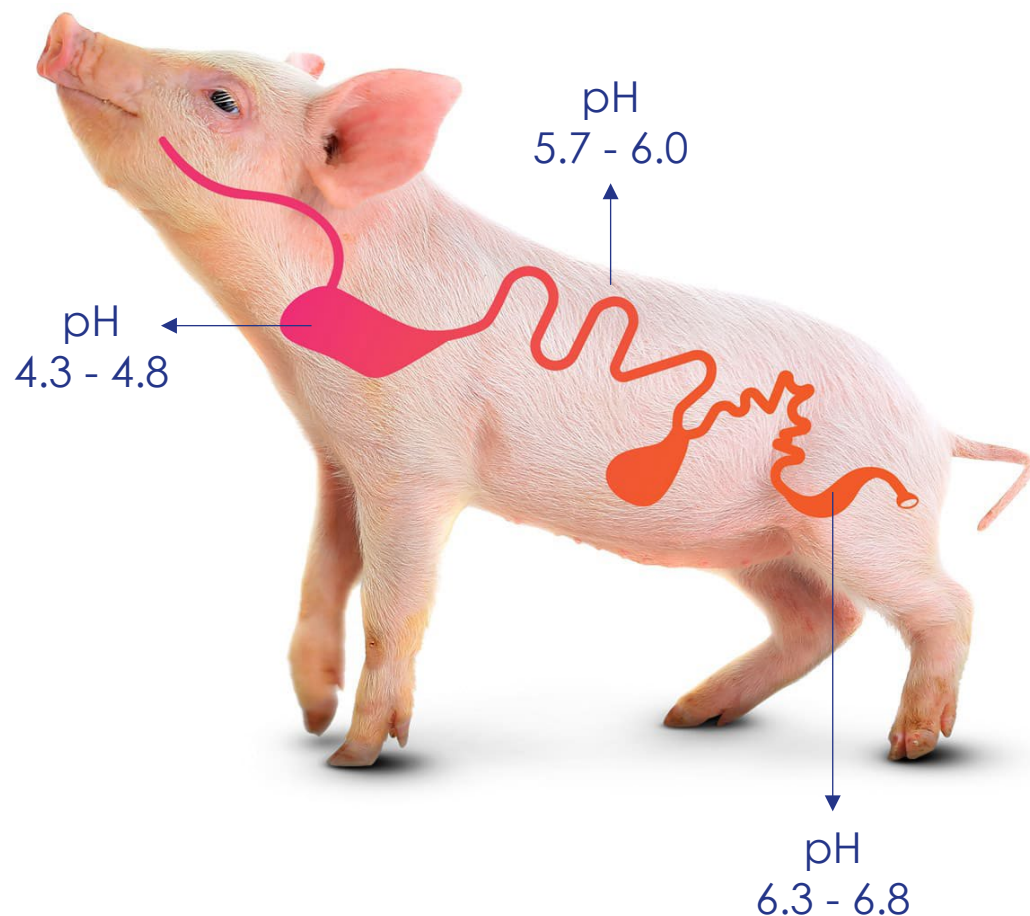
**Dr. Yron Joseph Y. Manaig**, Jonathan Riedmüller, Jamil E. G. Faccin, Stéphane Durosoy, Jürgen Zentek, Joel M. DeRouchey, Jordan T. Gebhardt, Robert D. Goodband, Jason C. Woodworth, and Michael D. Tokach



# The piglet stomach

Post-weaned piglets has a stomach pH around **4**.

Due to immaturity, piglets are not able to consistently keep a low pH.



- Consequence 1: Protein indigestion

- Pepsin activity (pH 2-3.5)
- inflammation, gut disorders,
- ...and **DIARRHEA**.

- Consequence 2: Pathogen growth

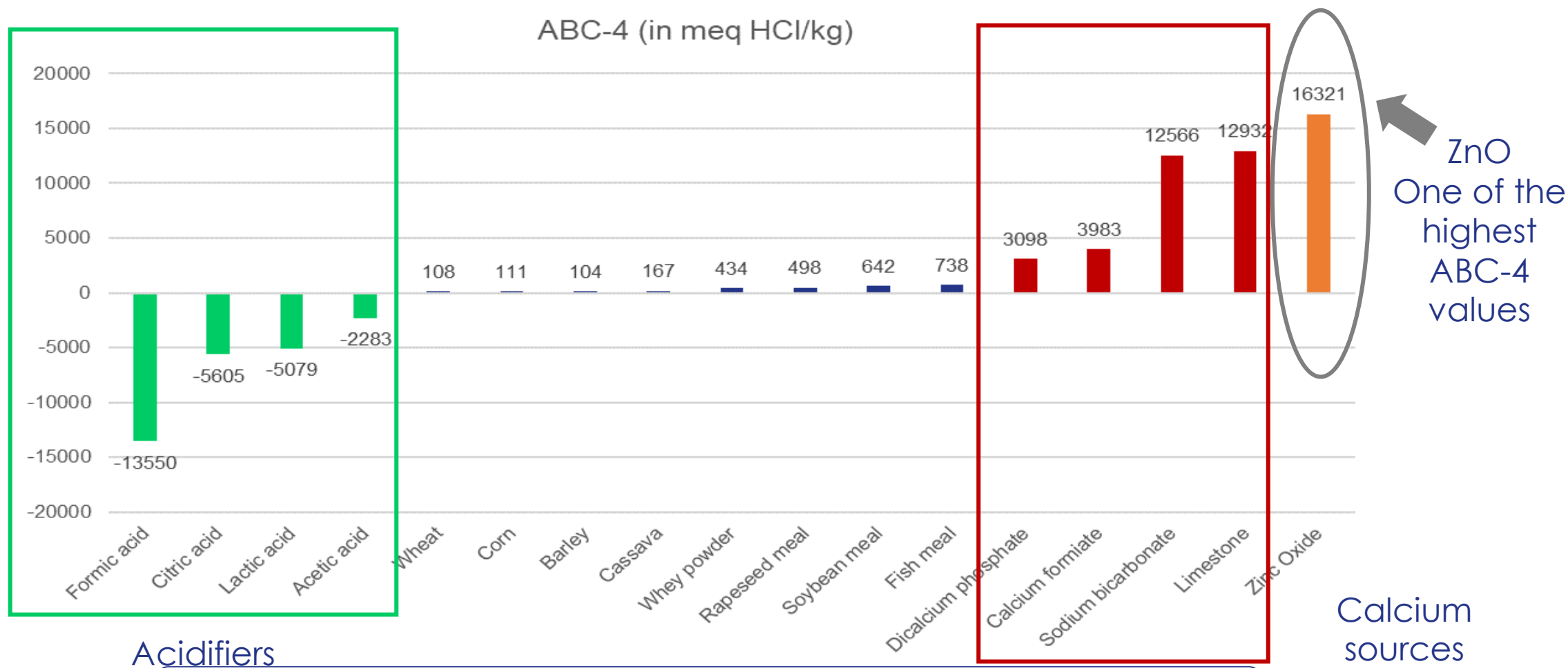
- Optimum gut pH levels
  - *E. coli* 6-8
  - *Streptococci* 6-7.5
  - *Salmonella* 6-7.5
  - *Staphylococci* 6.8-7.5
  - *Pseudomonas* 6.6-7.0
- Proliferation of microflora and pathogens ...and **DIARRHEA**.



# Acid Binding Capacity at pH 4 (ABC-4) of feed ingredients



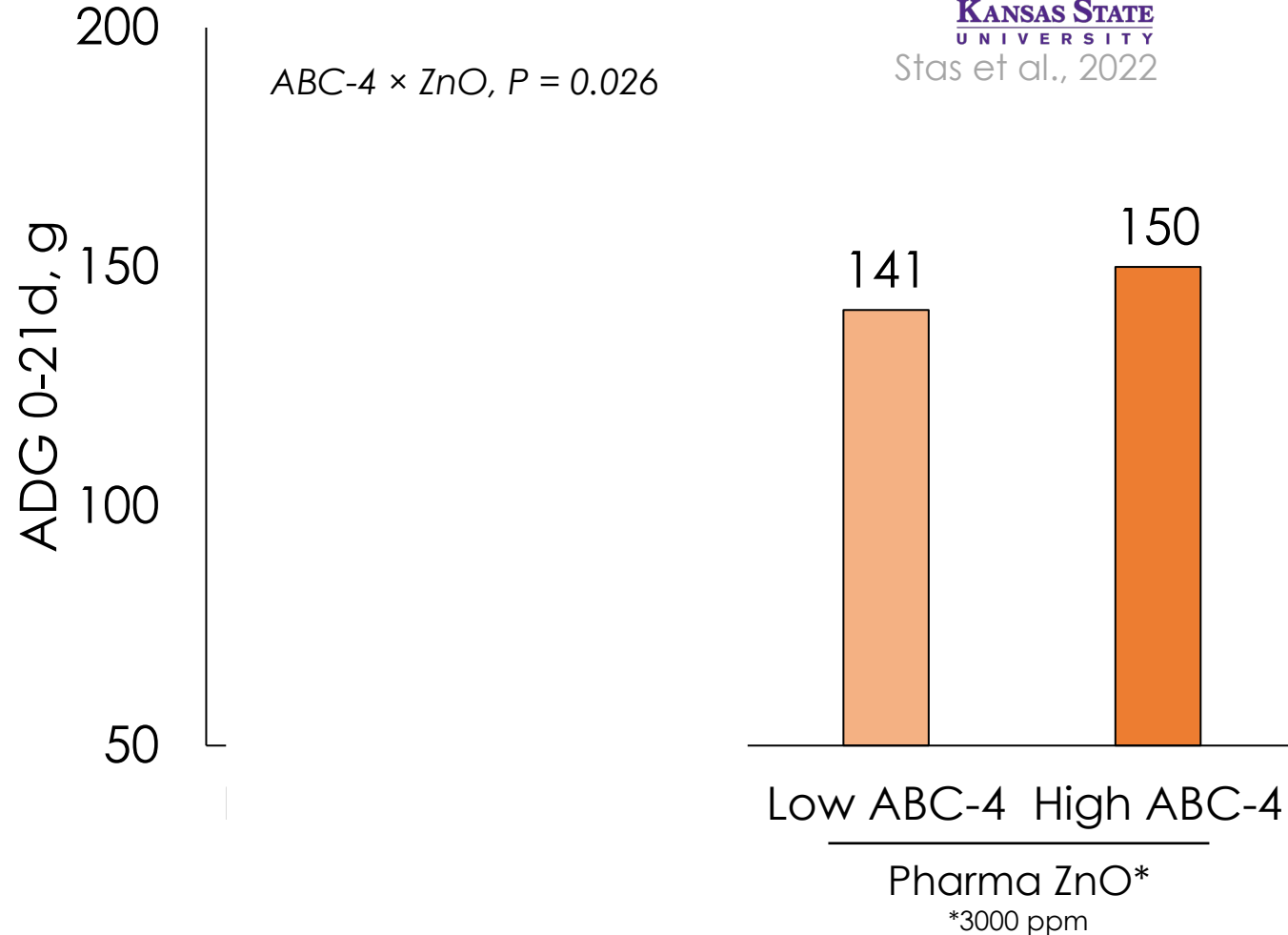
- A plain titration method: measured as the amount of acid in **milliequivalents** (meq) required to lower 1 kg of an ingredient or diet to a pH of **4**.



Attention to the ABC-4 values of the piglet's diet



# Effects of varying the ABC-4 in diets with or without pharma ZnO



Recommended range of ABC-4 values for post-weaning piglets.

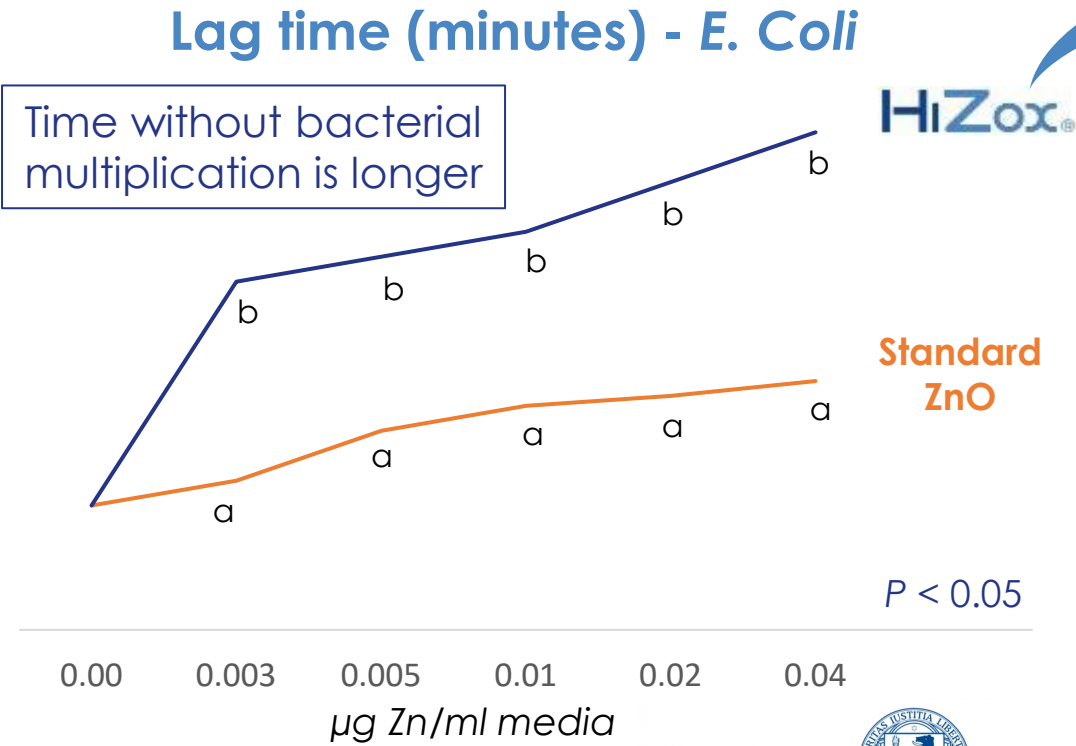
| ABC-4 value (meq HCl/ kg) | Phase 1 (0 to 10 d) | Phase 2 (11 to 24 d) |
|---------------------------|---------------------|----------------------|
| Minimum                   | 200                 | 250                  |
| Maximum                   | 250                 | 300                  |

Reduced ABC-4 values as an alternative to high ZnO diets, without impairing piglet performance.



# HiZox®, a potentiated zinc oxide

- Has average density, large particle size, and high specific surface area



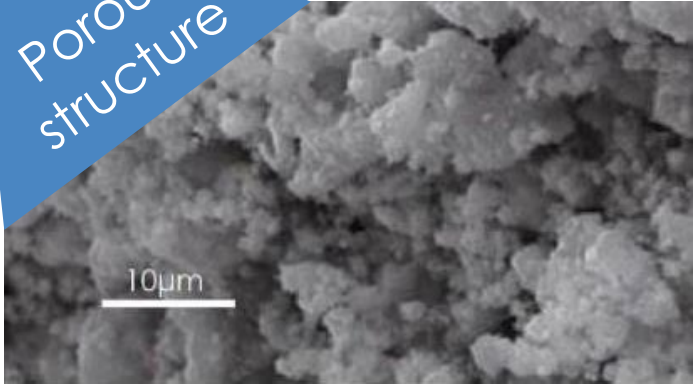
Zentek and Vahjen, 2012

Freie Universität Berlin



Porous structure

electron microscope



|  | <br>@ 110ppm | <br>@ 3000 ppm |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Final BW (kg)                                                                       | 17.93 <sup>a</sup>                                                                              | 16.51 <sup>b</sup>                                                                                |
| ADG (g/d)                                                                           | 424.3 <sup>a</sup>                                                                              | 358.8 <sup>b</sup>                                                                                |
| FCR                                                                                 | 1.44 <sup>b</sup>                                                                               | 1.71 <sup>a</sup>                                                                                 |

$P < 0.05$

Morales et al., 2012

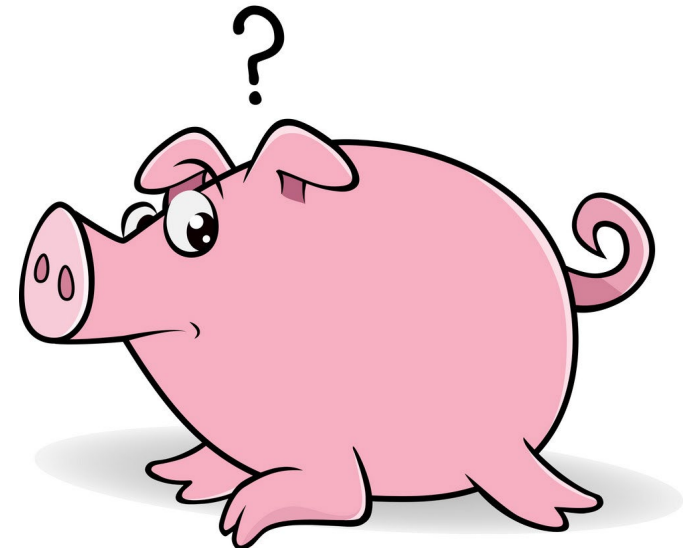
HiZox® unique physico-chemical properties, optimal dissolution kinetics, higher digestibility, stronger antibacterial effect = **better *in vivo* performance**



# Objective of the Study



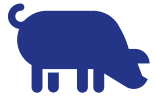
This study aimed to evaluate the effects of diets containing different levels of a potentiated Zn source, **PZn** (HiZox®, Animine, France) in low ABC-4 diets on growth performance, fecal score and dry matter (DM).



# Materials and Methods



Kansas State University, USA



240 male piglets (DNA 200 × 400, BW 5.90 ± 0.05 kg)  
weaned at 21d; 12 pens of 5 animals each



2 phase diets (phase 1 d0-10; phase 2 d11-24) + acidifiers



GLIMMIX procedure of SAS;  
P < 0.05 = significant  
0.05 < P < 0.10 = tendency

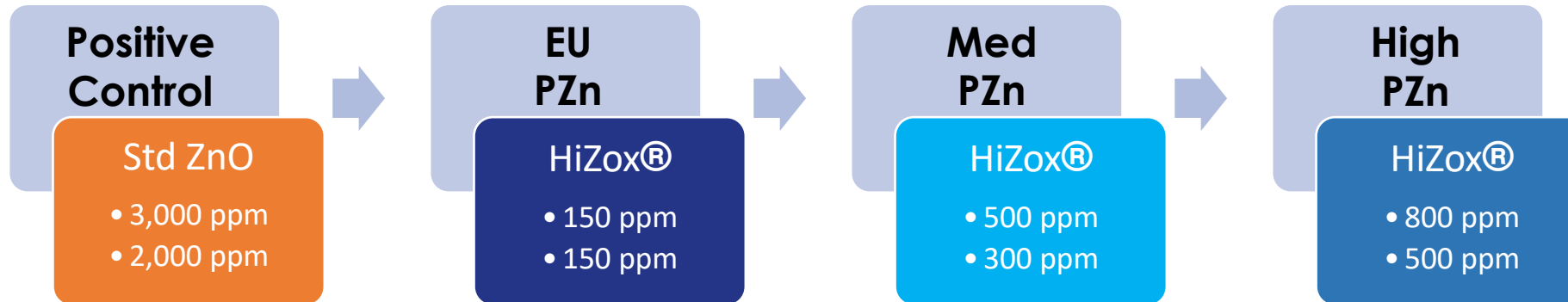


24d of study



Growth performance; Fecal score and diarrhea incidence

Treatments



| ABC-4 in Phases 1 and 2 |            |            |            |
|-------------------------|------------|------------|------------|
| 296 mEq/kg              | 209 mEq/kg | 221 mEq/kg | 230 mEq/kg |
| 309 mEq/kg              | 253 mEq/kg | 258 mEq/kg | 265 mEq/kg |



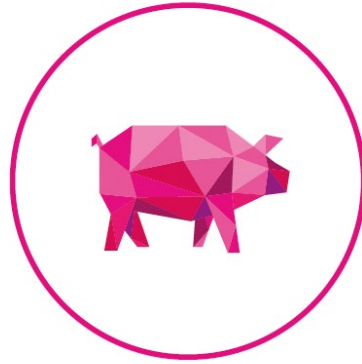
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Animine  
Precision minerals



| Phase 1                |                  |        |         |          |
|------------------------|------------------|--------|---------|----------|
| Ingredients, %         | Positive Control | EU PZn | Med PZn | High PZn |
| Corn                   | 49.6             | 50.1   | 50.0    | 49.9     |
| Soybean meal (46% CP)  | 16.1             | 16.0   | 16.0    | 16.0     |
| Lactose                | 15.0             | 15.0   | 15.0    | 15.0     |
| Corn oil               | 2.00             | 2.00   | 2.00    | 2.00     |
| Fermented soybean meal | 9.75             | 9.75   | 9.75    | 9.75     |
| S-D bovine plasma      | 2.50             | 2.50   | 2.50    | 2.50     |
| L-Lys-HCl              | 0.44             | 0.44   | 0.44    | 0.44     |
| Other AA               | 0.62             | 0.62   | 0.62    | 0.62     |
| Vitamins and minerals  | 2.57             | 2.57   | 2.57    | 2.57     |
| Fumaric acid           | 0.50             | 0.50   | 0.50    | 0.50     |
| Formic acid            | 0.50             | 0.50   | 0.50    | 0.50     |
| ZnO                    | 0.42             | ---    | ---     | ---      |
| HiZox <sup>®</sup>     | ---              | 0.02   | 0.07    | 0.11     |
| ABC-4, meq/kg          | 296              | 209    | 221     | 230      |

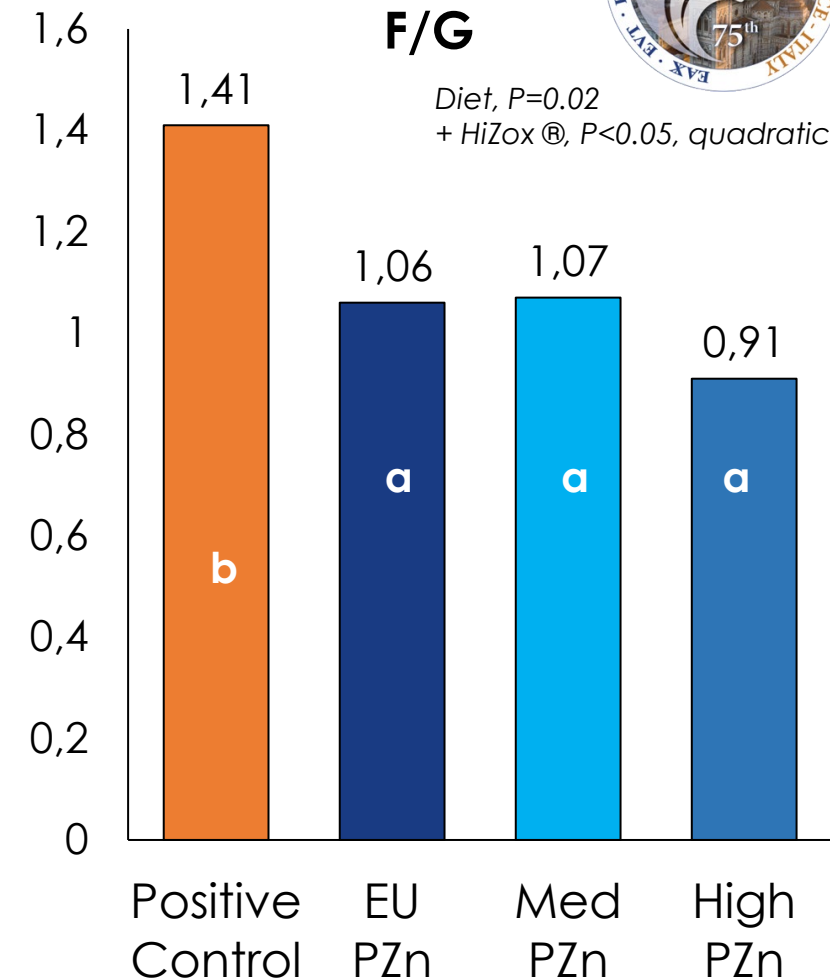
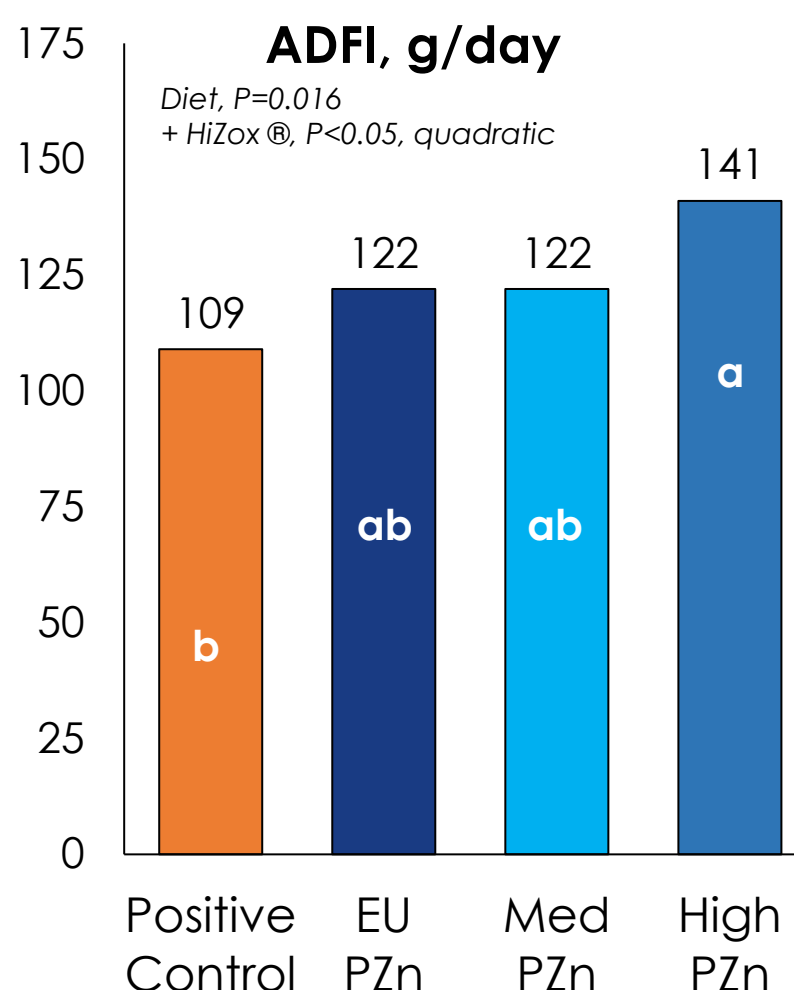
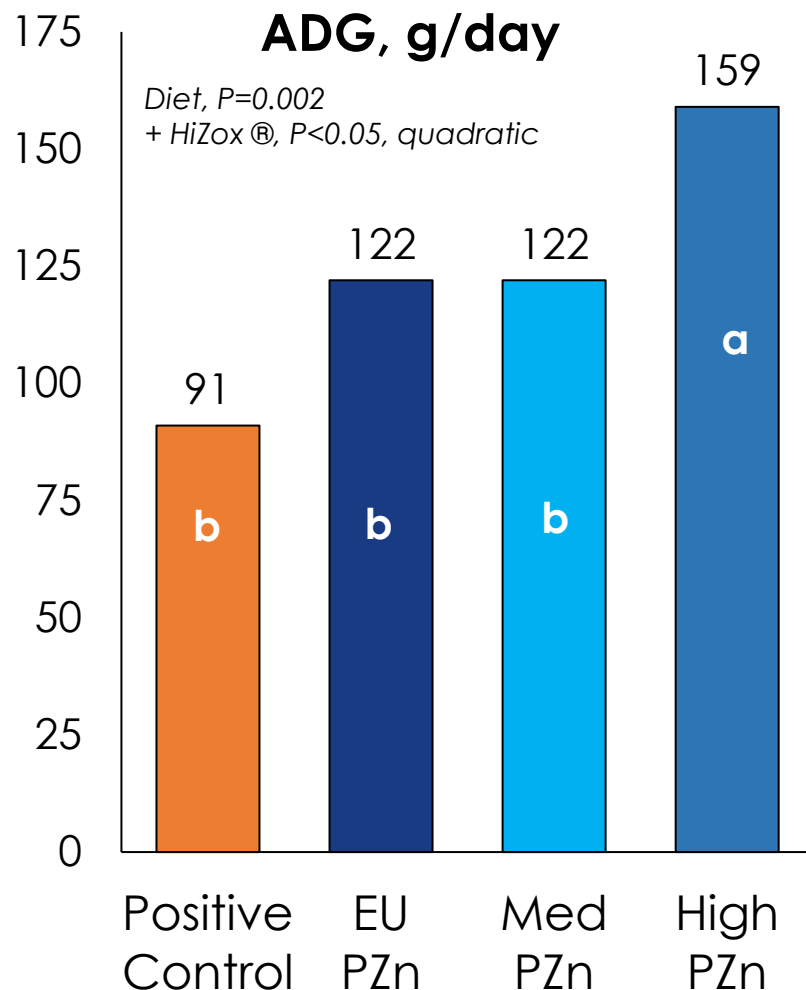




# Growth Performance Phase 1 (d0-d10)



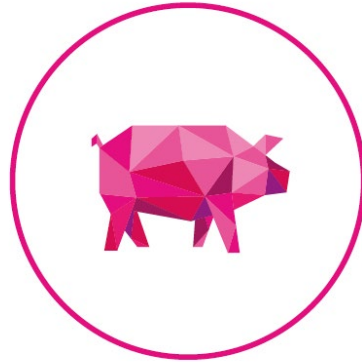
# Growth performance, d0 to d10 (Phase 1)



Increasing addition of PZn improved ADG, ADFI, and F/G;  
performed better or equal to pharmacological dose of ZnO

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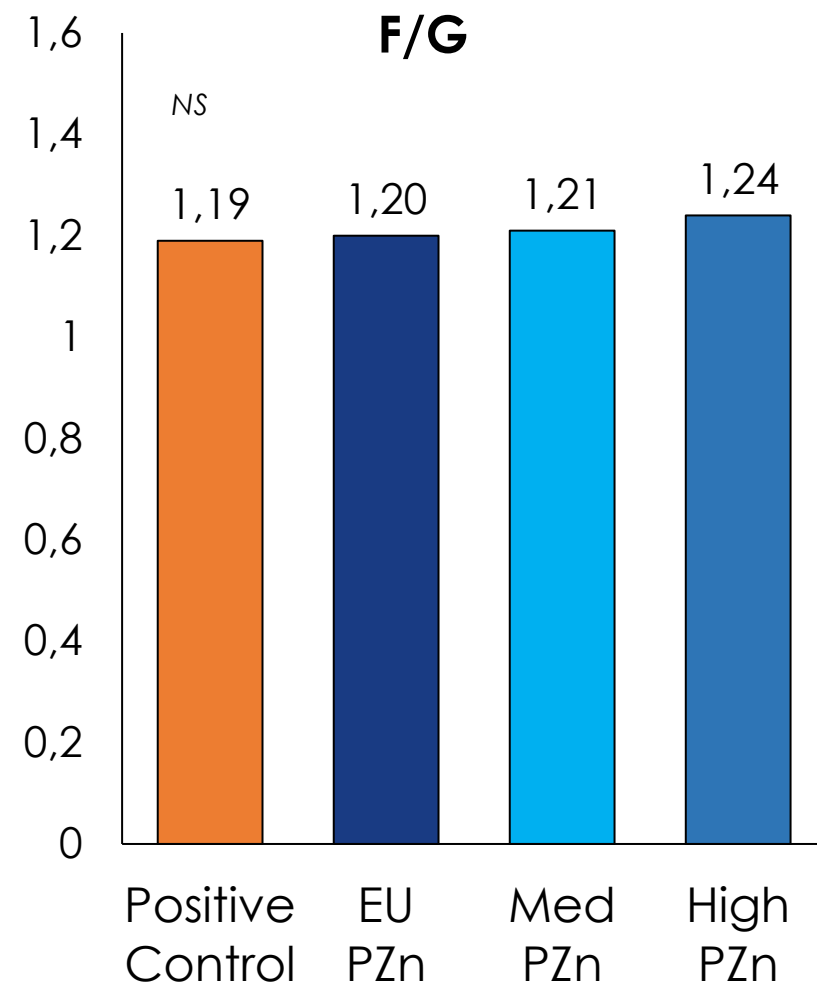
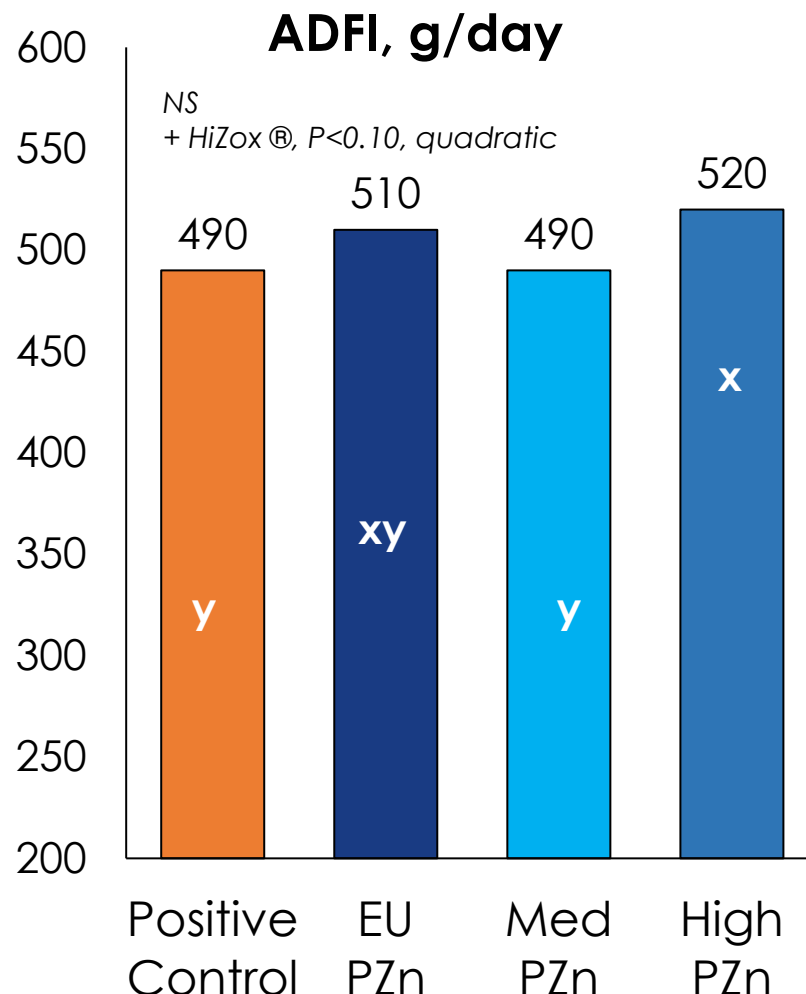
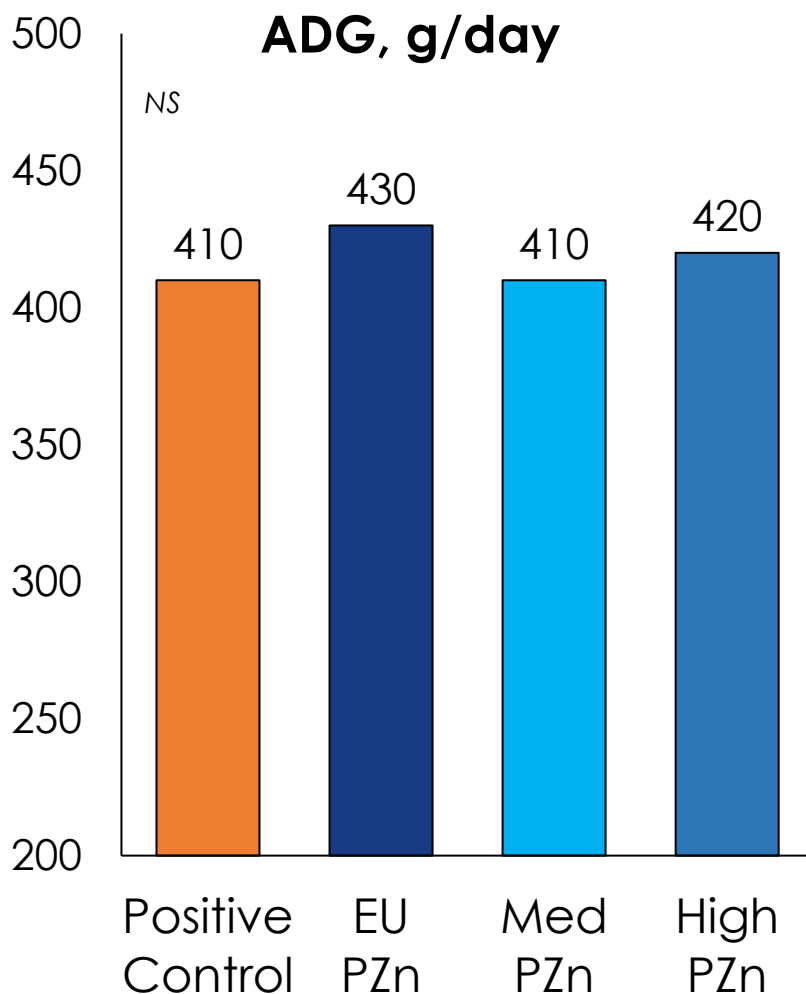




# Growth Performance Phase 2 (d11-d24)

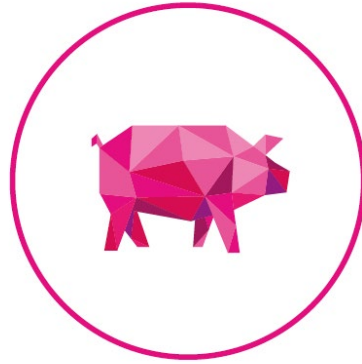


# Growth performance, d11 to d24 (Phase 2)



No significant differences were observed; there was a tendency for a quadratic increase in ADFI with increasing PZn levels

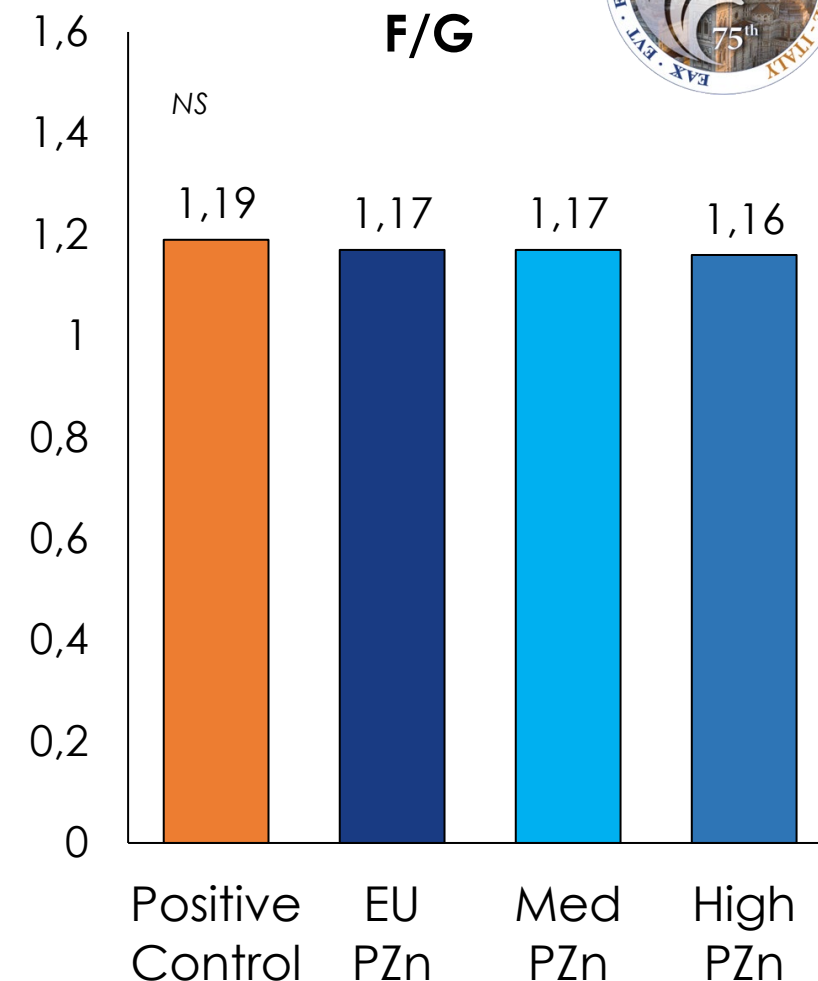
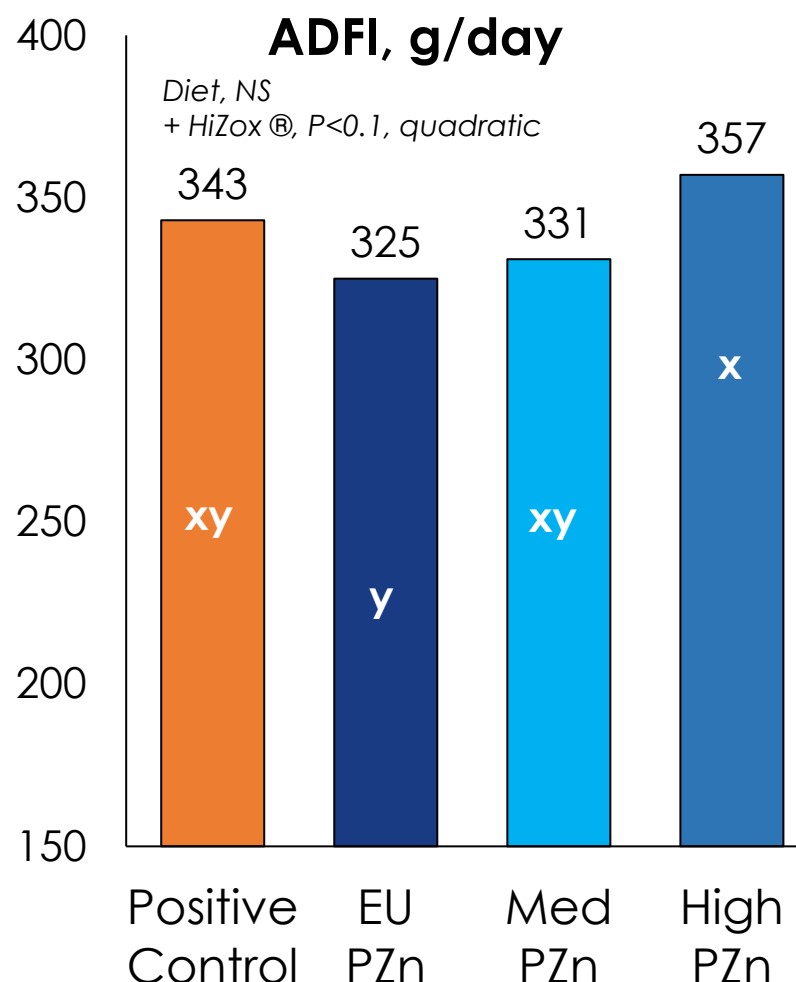
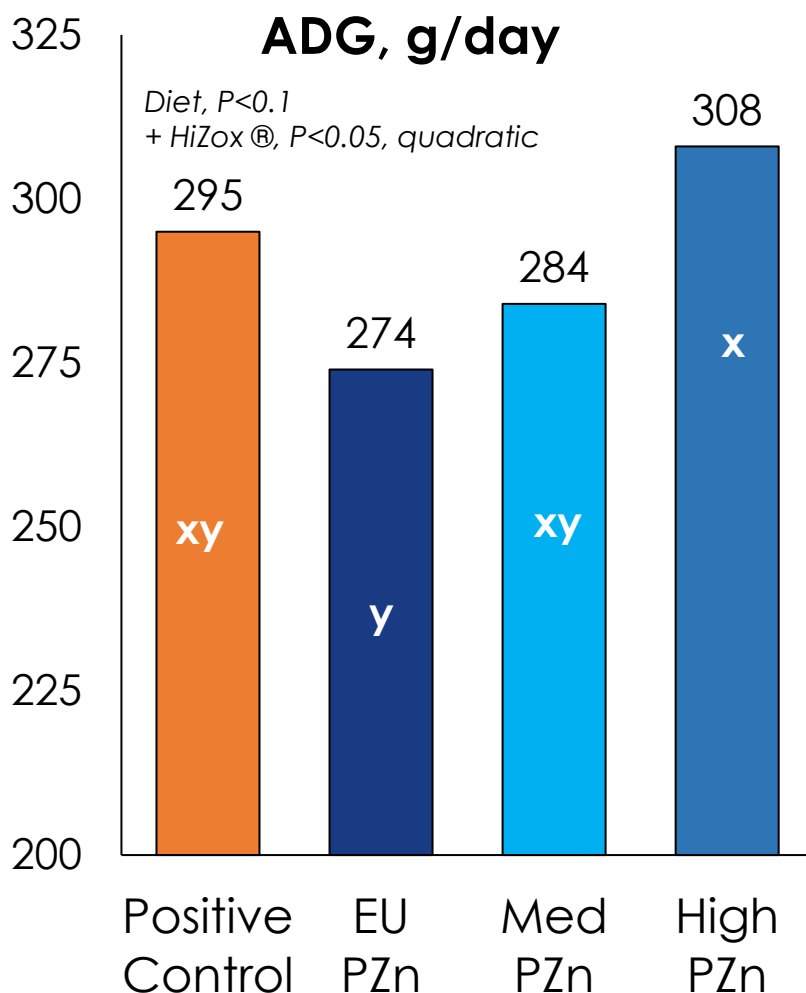




# Growth Performance Overall (d0-d24)

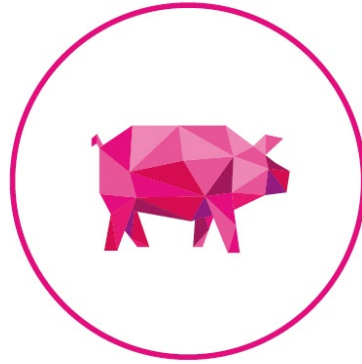


# Growth performance, d0 to d24 (overall)



Tendency for higher ADG with High PZn, while increased PZn levels quadratically improved ADG and ADFI.





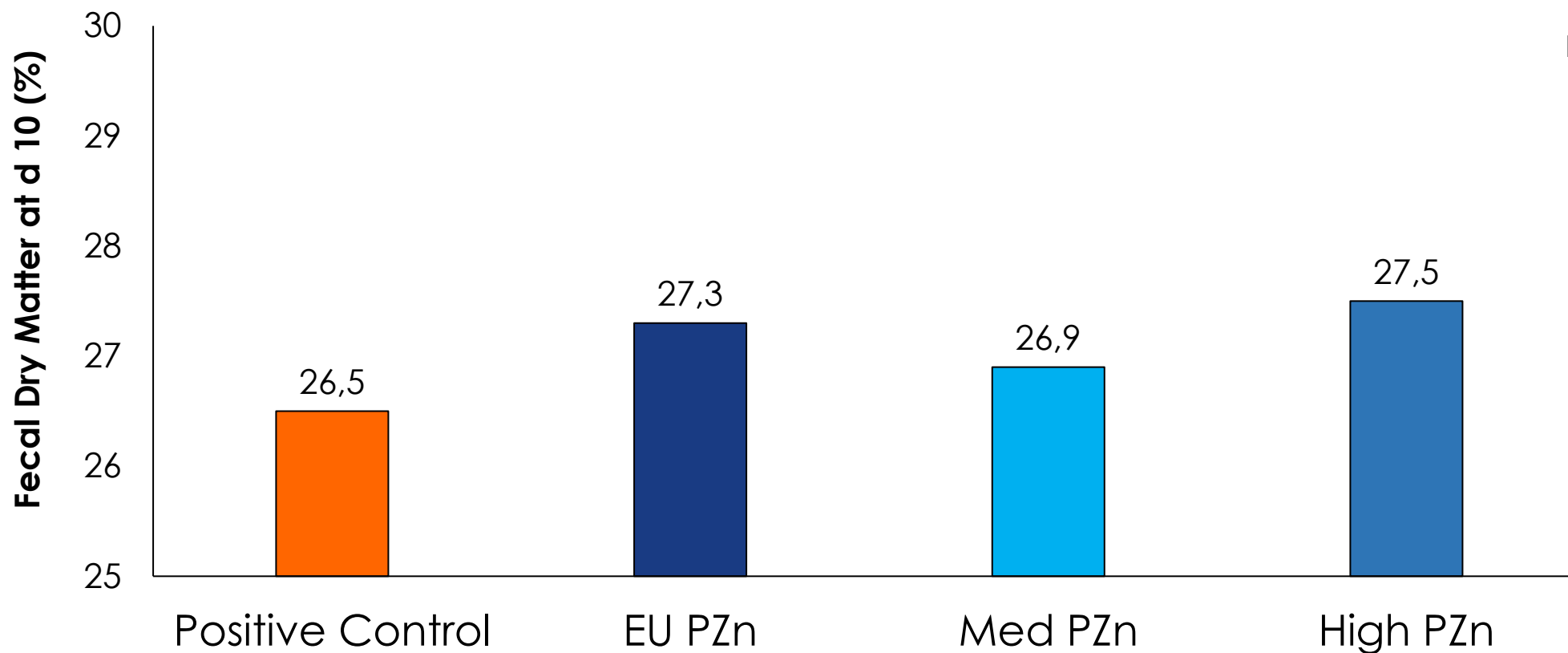
# Fecal characteristics



# Fecal dry matter at d 10



NS



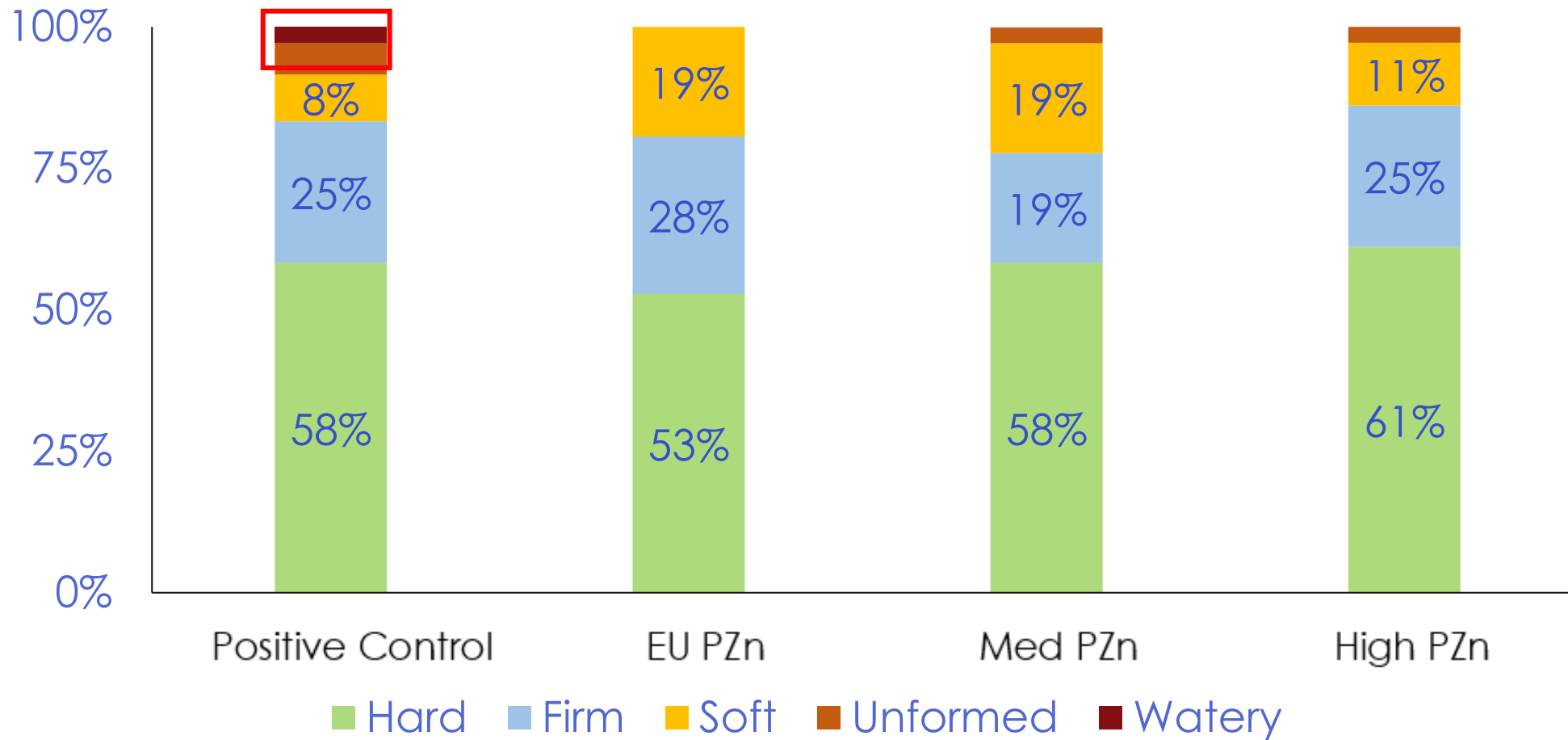
In the first 10 days after weaning, PZn presented a good control of diarrhea as pharmacological ZnO

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# Frequency of fecal consistency at d10

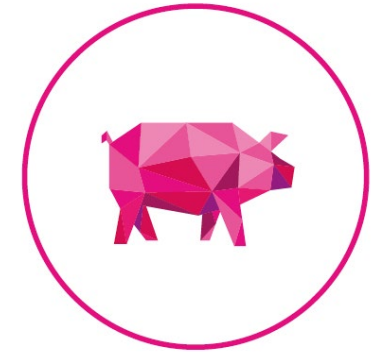


PZn can replace pharma ZnO with similar fecal consistency;  
Increased level of PZn increases hard feces consistency



# Conclusions

- In summary, the use of PZn as an alternative to high ZnO maintains comparable performance and fecal consistency while enhancing growth performance.
- The use of PZn during the first 10 days after weaning could present an effective way to alleviate PW stress and diarrhea.
- The combination of HiZox® and low ABC-4 concept is an effective way to replace the high dietary levels of zinc oxide used in nursery piglet diets.



**HiZox®**

potentiated zinc oxide

**119 Animine**  
Precision minerals



# Thank you for your attention!



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