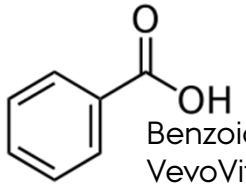
ACIDIFYING FEEDING OF FINISHER PIGS

JAN VÆRUM NØRGAARD
DEPT. OF ANIMAL SCIENCE
AARHUS UNIVERSITY, FOULUM
JAN.NOERGAARD@AGRSCI.DK

Abstract #18897: Effect of benzoic acid and calcium chloride on microbiota, mineral balance and bone in growing pigs. EAAP Annual Meeting 2014, Copenhagen, Denmark
Session 07 "Feeding (and management) to improve gut barrier function and immunity in livestock"
25 August 2014

BACKGROUND

- Benzoic acid (BA) in pig diets
  - Approved in EU as a feed supplement to reduce acidity of slurry
- We have worked on BA in several projects
  - BA reduces pH of urine and slurry and NH_3 emissions during storage
  - BA is efficiently converted into hippuric acid and excreted
  - Results in small but significant reductions in blood pH
  - No/small BA effect on P and Ca balances in short studies
- Next question to ask
  - Any long-term effects of BA on mineral balance and bone strength?



Benzoic acid
VevoVitall® from DSM

HYPOTHESES

- BA can be used to lower urine pH
- By reducing the dietary electrolyte balance (dEB), urine pH will be lower
  - (dEB ≈ DCAD ≈ $Na^+ + K^+ - Cl^-$ in meq/kg DM)
- Replacing $CaCO_3$ by $CaCl_2$ → lower dEB
- Acidifying feed → lower urine pH → lower slurry pH → lower NH_3 emission during storage
- Both BA and $CaCl_2$ make up a risk of metabolic acidosis + mobilization of bone minerals to buffer blood pH
- In the longer term, BA and $CaCl_2$ reduce bone strength

CONCEPTS OF TREATMENTS

› 4 diets in two-factorial design
  › +/- 1% BA
  › Ca from either $CaCO_3$ or $CaCl_2$

Control	**+Benzoic acid**	**Low dEB**	**Low dEB +Benzoic acid**
-BA/+$CaCO_3$	**+BA/+$CaCO_3$**	**-BA/+$CaCl_2$**	**+BA/$CaCl_2$**
14 g/kg $CaCO_3$	14 g/kg $CaCO_3$	20 g/kg $CaCl_2$	20 g/kg $CaCl_2$
0 g/kg BA	10g/kg BA	0 g/kg BA	10g/kg BA

PROTOCOL

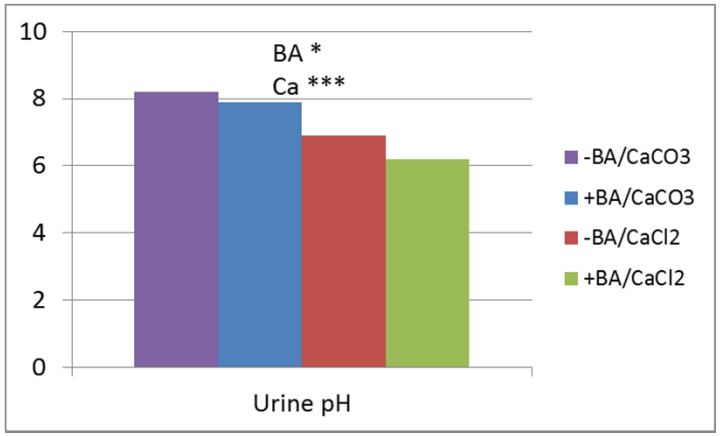
- 24 female pigs
- Duration from 36 – 113 kg
- Housed individually
- Ad libitum feeding
- Metabolism crates from 60-66 kg
  - P and Ca balances
- Slaghter at 113 kg
  - Digesta collected
    - pH, organic acids
  - Metacarpal bones dissected
    - CT-scanning, mineral analysis etc.

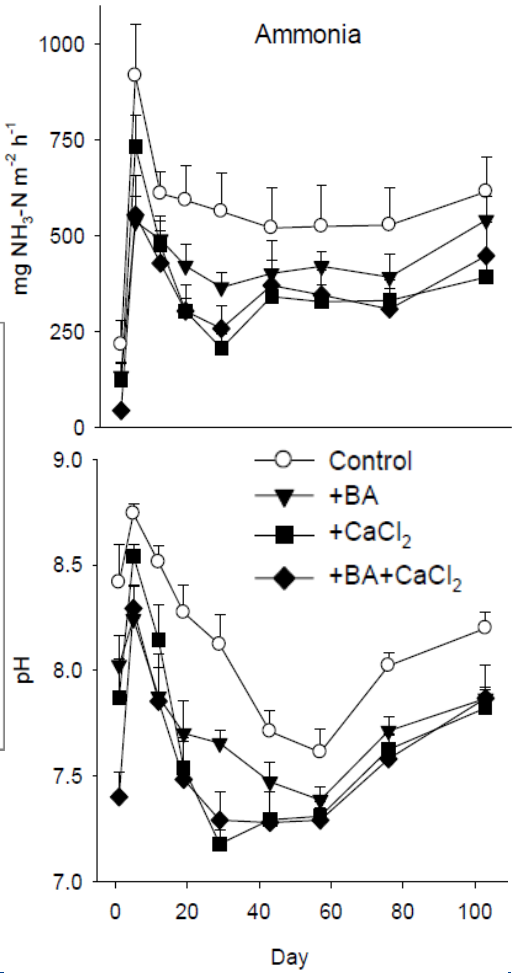
BROAD RESEARCH TEAM

- Ole Højberg
  - Evaluation of organic acids in digesta
- Juan M.S. Medina
  - CT scanning
- Jørgen Eriksen
  - Environmental impact
- Jan V. Nørgaard
  - Mineral balance

RESULTS

- Urine pH
  - Reduced by both treatments
  - From pH 8.2 to 6.2
- Slurry storage
  - pH reduced by 0.4-0.6 units
  - NH_3 emission reduced by 28-40%

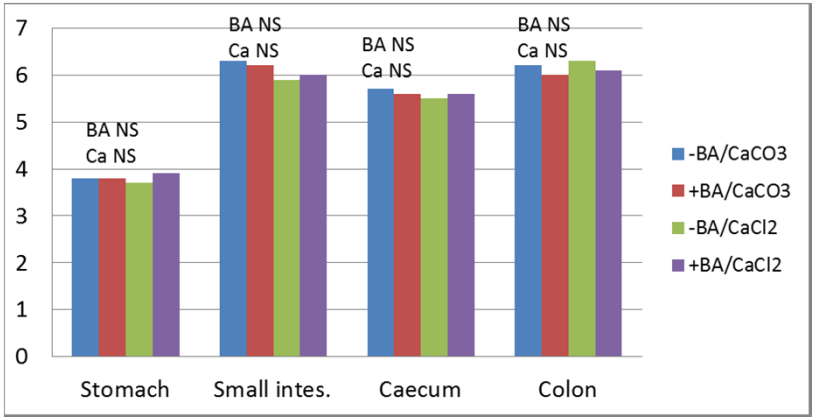




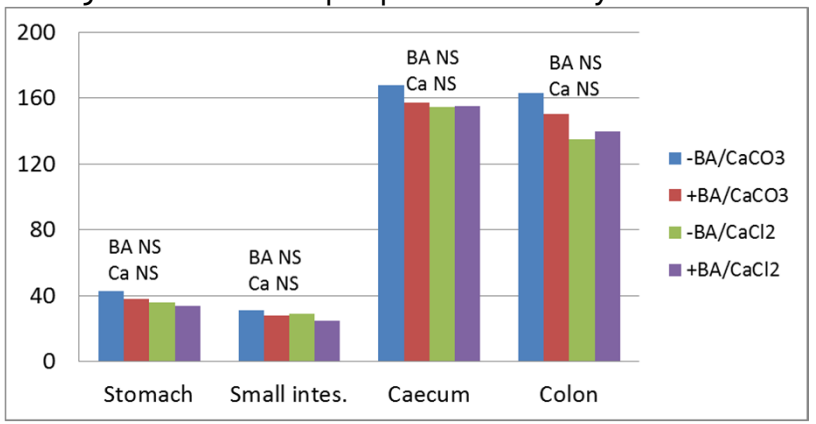
RESULTS

- Digesta samples
  - Stomach
  - Small intestine
  - Caecum
  - Colon
- Neither BA nor Ca source reduced pH and conc. or organic acids significantly
- Microbial activity was not affected

Digesta pH



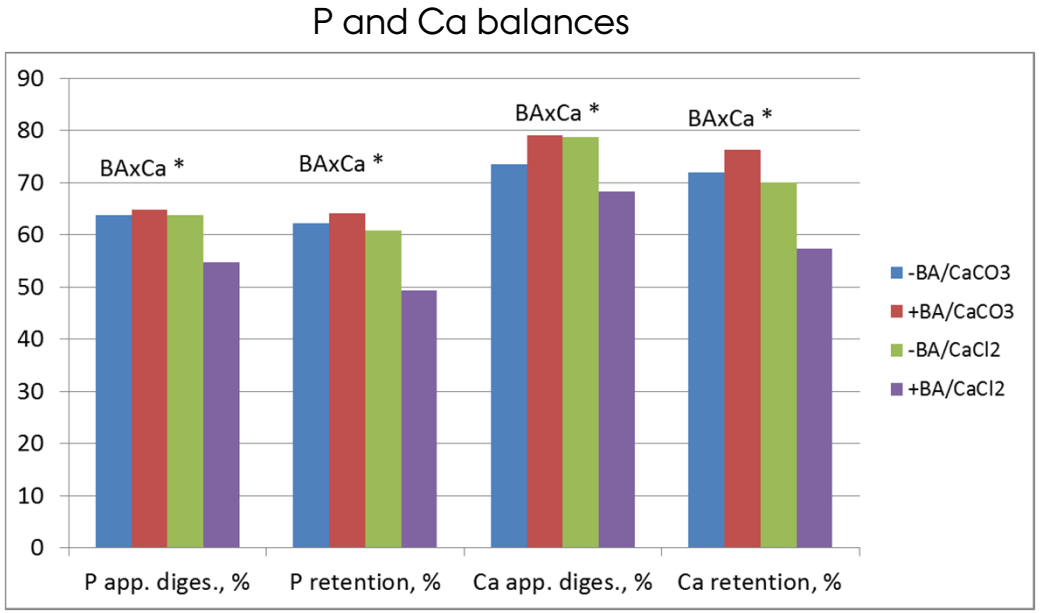
Digesta acetate+proprionate+butyrate conc.



RESULTS

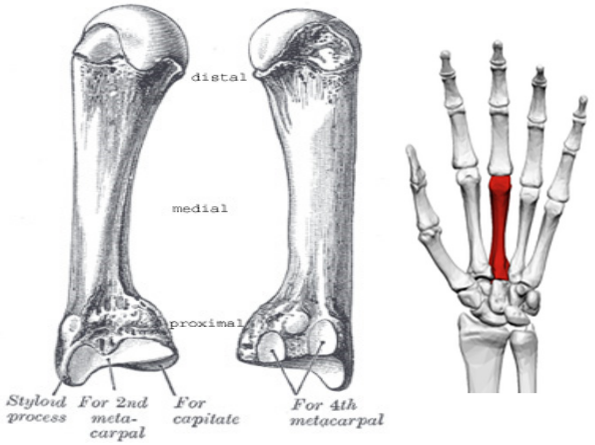
› P and Ca balances were affected by neither BA nor by replacing $CaCO_3$ with $CaCl_2$ …

› But the combined effect (+BA/$CaCl_2$) reduced apparent P and Ca digestibility and retention

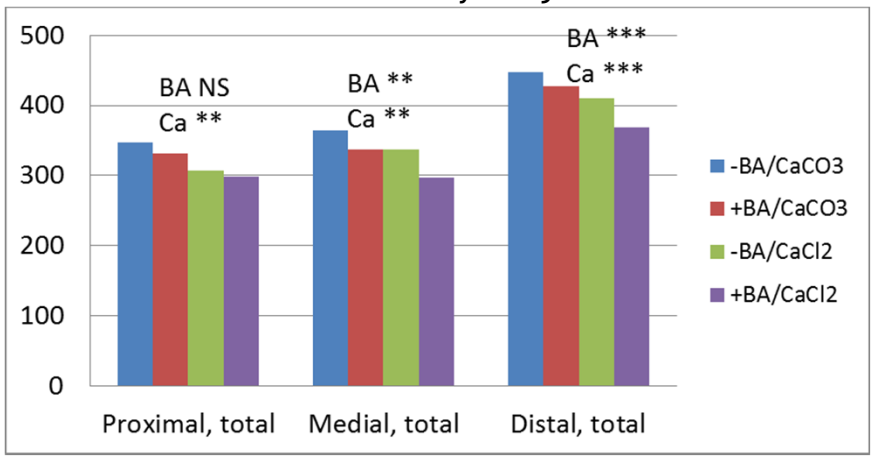


RESULTS

- Metacarpal III bones
  - Weight and length was reduced by $CaCl_2$ but not by BA
  - Ash and P reduced by both treatments
  - Mineral density (mg/cm^3) was reduced by both treatments



Mineral density (mg/cm^3)



CONCLUSIONS

- Urine pH, slurry pH, and NH_3 emission were reduced by BA and by replacing $CaCO_3$ with $CaCl_2$
- GI-tract pH and microbial organic acids (activity) were not affected
- P and Ca apparent digestibility and retention were reduced by the combined effect of BA and replacement of $CaCO_3$ with $CaCl_2$
- Mineral density of metacarpal III bones was reduced both by BA and by replacing $CaCO_3$ with $CaCl_2$
- BA and $CaCl_2$ are not considered to affect bone strength severely, but their combined effect may reduce bone strength during long-term feeding

› Thank you!

› Jan Værum Nørgaard
› Dept. of Animal Science
› Aarhus University, Foulum
› Jan.noergaard@agrsci.dk

› Abstract #18897: Effect of benzoic acid and calcium chloride on microbiota, mineral balance and bone in growing pigs
› Just published: Nørgaard et al., 2014, September issue of Anim. Feed Sci. Technol., 58-66
› Just accepted: Eriksen et al., part on emissions from slurry. J. Environ. Qual.