Effects of diet microbial phytase, vitamin C and copper levels on cadmium retention in slaughtered pigs

Eric Royer and Nathalie Lebas
Ifip-institut du porc, France
Cadmium in agricultural soils

Agricultural soil concentration

Total deposition in 2009

Report 'Sustainable Agriculture and Soil Conservation'
eussoils.jrc.ec.europa.eu

EMEP data
www.msceast.org

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Background and aims of the study

Regulation and its evolution
- maximum levels in feed- and foodstuffs
  - food (Regulation 1881/2006 of Commission)
- EFSA Scientific report (2012): average Cd dietary exposure too high
- Commission’s review of Cd maximum levels: reducing Cd in foods

Respecting pig feed limits ≠ compliance of pork offals
- continuous exposure < max $[\text{Cd}]_{\text{diets}} \rightarrow [\text{Cd}]_{\text{kidney}} >$ tolerance (Royer and Lebas, 2010a,b).
- EU pig tissue controls: 0.6 % in 2009 & 1.2 % in 2010 non compliants

How to limit Cd accumulation in pig kidneys?
- effects of microbial phytase, vitamin C and copper in diets
Material and methods: 4 diets

Non contaminated (control) vs contaminated diets

(± 0.5 mg Cd/kg = maximal limit in feeds)

- **PHYT**: with phytase (1000 FTU),
- **PHOS**: without phytase (+ 0.6 g P),
- **CuVitC**: with phytase, vitamin C (1000 then 700 mg/kg) and lower Cu content (44 mg/kg in phase 2 diet).

Contamination resulting from raw materials

- Limit for feed materials
- Experimental feedingstuffs
- mean [Cd] ±SD , EFSA 2004
Experimental design: 36 female pigs

Control Phytase Phosphorus Phyt / Cu-/ VitC+

Phase 2
Growing
Finishing

13.5 kg → 113 kg

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Results: effect of diets on kidney Cd concentration

Feed: P < 0.001
Exposure time: P < 0.001

Kidney Cd concentration in μg/kg

- Phytase
- Phosphorus
- Phyt/Cu-/VitC+

Max limit 1881/2006
Commission proposal

Control, d27, d69, d132
Discussion

Effect of phytase

- Phytase \( \rightarrow \) renal Cd of pigs fed 0.78 mg Cd/kg (Zacharias et al., 2001)
- Microbial phytase \( \rightarrow \) liberation of Cd phytate

Effect of copper

- \([\text{Cd}]_{\text{kidney}} \times 2 \leftarrow [\text{Cu}]_{\text{fattening feeds}} \rightarrow 175 - 200 \text{ mg/kg} \) (Rambeck et al, 1991. Rothe et al, 1994.)
- \([\text{Cu}]_{\text{fattening feeds}} \) now limited 25 mg/kg, reducing \([\text{Cu}]_{\text{phase 2}} \) ?
- Cu \( \rightarrow \) MT’s synthesis. Displacement of Cu from MTs by Cd ?

Effect of vitamin C

- Influence shown in rats (Grosicki, 2004) and pigs (Rothe et al., 1994)
- Supplemental vitC \( \downarrow \) Cd distribution and \( \uparrow \) Fe absorption.
Conclusions

Feed and food safety issues

- Lower maximum limits for kidneys under discussion
- Role of feeding practices: information of feed manufacturers about quality of mineral feedstuffs

Adjusting the diet parameters

- Phosphorus and calcium levels, supplemental phytase
- Copper content
- Vitamin C addition

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Thank you for your attention.

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