



Influence of dietary calcium on growth performance and mineral status in weaned piglets.



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Materials and methods

Two experiments

Diet	Exp 1	Exp 2
DE [MJ/kg]	14.0	14.0
CP [g/kg]	170	186
P [g/kg]	4.1	4.2
Phytic P [g/kg]	n.d.	2.4
Phytase [FTU/kg]	1300	650
Digestible P [g/kg]	3.0	2.9

Treatments:

Exp 1: 2 treatments: **6 ; 8 g Ca / kg** (68 piglets; 4 pens)

Exp 2: 3 treatments: **4; 7; 10 g Ca / kg** (36 piglets; 3 pens)

Supplemented dietary Ca sources:

Exp 1: DCP (4.1 g/kg), Ca formiate (10 g/kg), CaCO₃ (0 – 6.1 g/kg)

Exp 2: Ca butyrate (2 g/kg), CaCO₃ (4.4 – 20 g/kg)

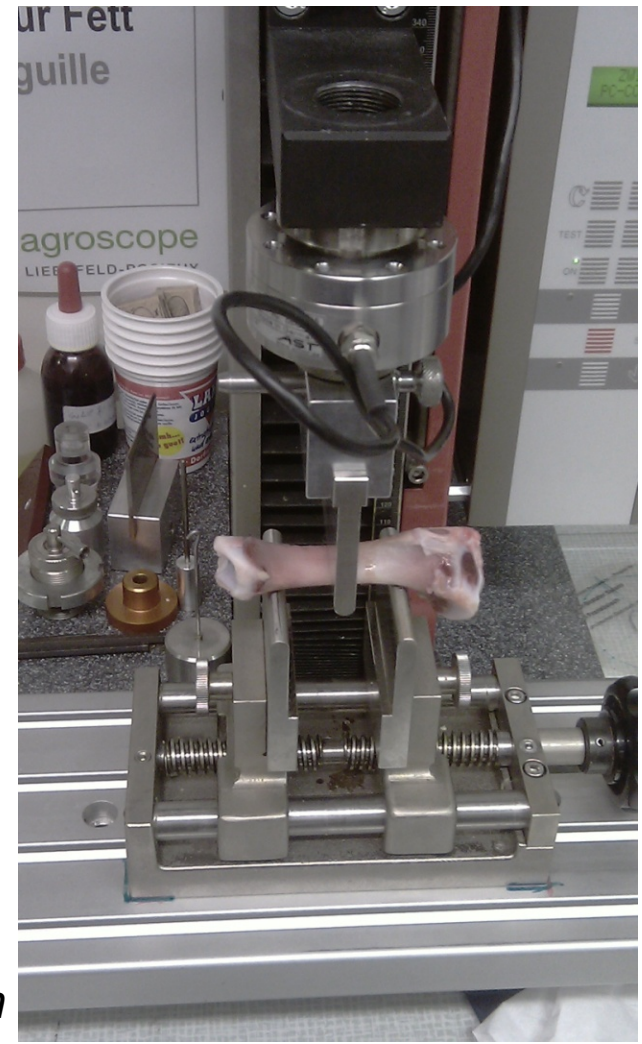
Materials and methods



Materials and methods

Data:

- Performance (FI, ADG, FCR)
- Urine (pH, creatinine, Ca and P content)
- Blood (Ca and P content in serum)
- Bone (ash, density, breaking strength)



Measure of bone (tibia) breaking strength

Materials and methods

Data analysis

GLM procedure

$$Y = a + a_{\text{block}} + Ca + Ca^2 + e$$

a is the intercept

a_{block} is the effect of the animal block on the intercept a

Ca is the dietary Ca content

e is the error

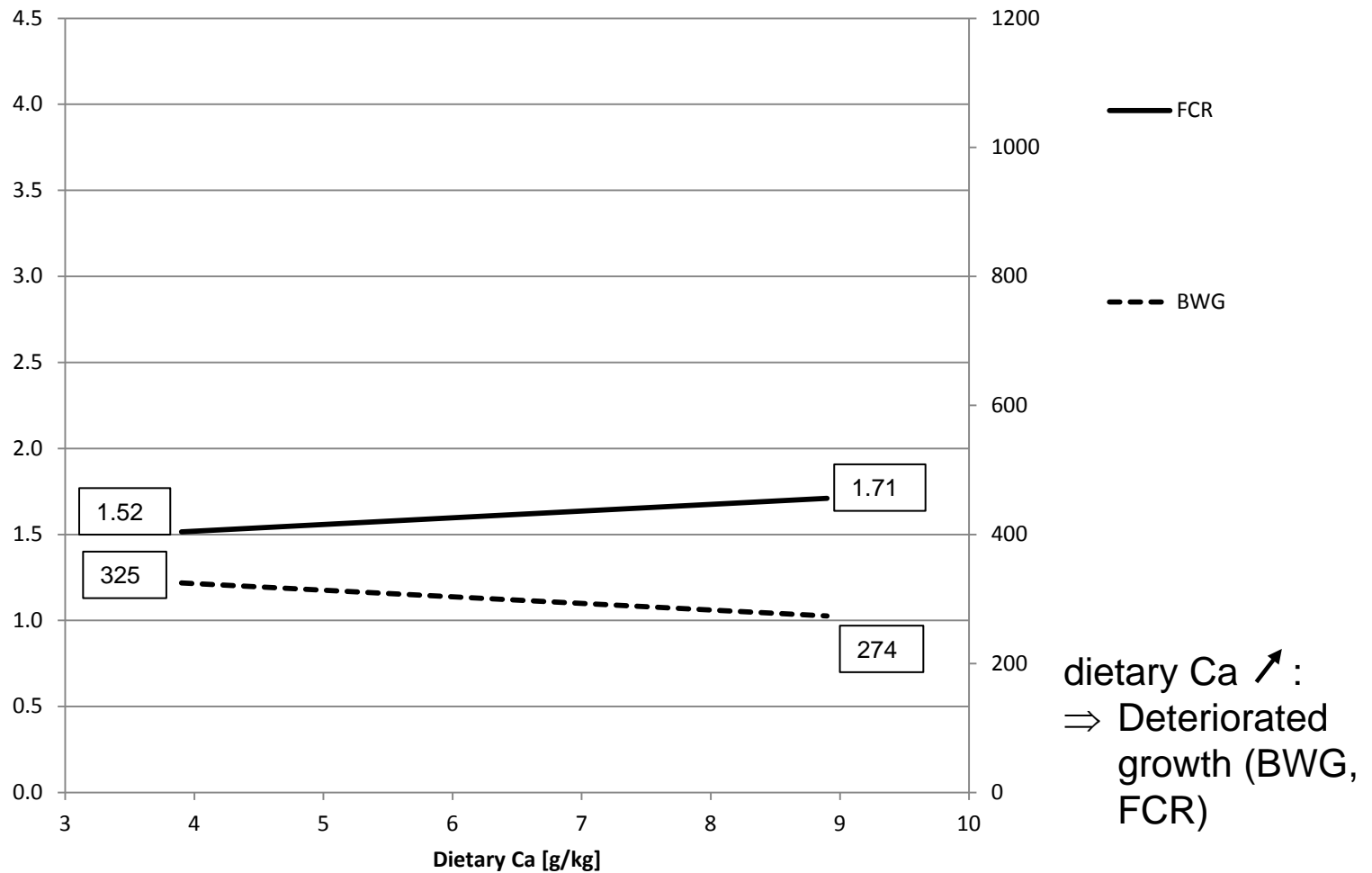
The piglet was considered as the experimental unit.

Results

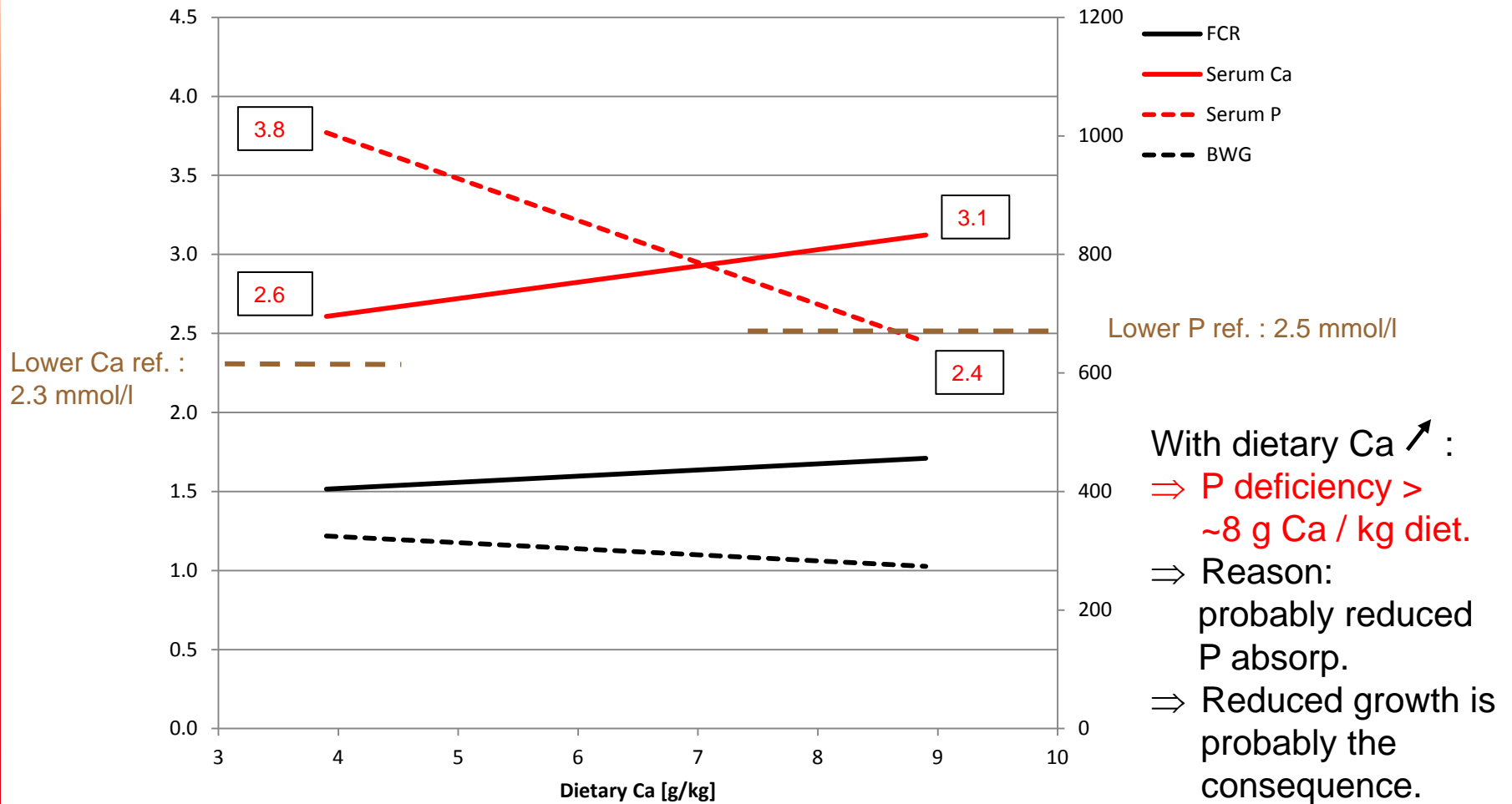
Variable	Unit	Intercept	Ca	Ca ²	P-values		R ²	r.m.s.e
					Ca	Ca ²		
BWG	[g/d]	365	-10.236		*	n.s.	0.51	72
FI	[g/d]	513			n.s.	n.s.	0.52	99
FCR		1.36	0.039		***		0.57	0.11
Urinary pH		7.50	-0.840	0.0817	+	*	0.85	0.5
Urinary Ca	[mol / mol creatinine]	-3.265	0.849		***	n.s.	0.84	1.1
Urinary P	[mol / mol creatinine]	7.60	-2.146	0.151	***	***	0.69	0.4
Serum Ca	[mmol/l]	2.21	0.103		***	n.s.	0.75	0.10
Serum P	[mmol/l]	4.80	-0.265		***	n.s.	0.70	0.30
Bone ash	[g/kg DM]	348	47.7	-3.082	+	+	0.41	35
Bone density	[g/cm ³]	0.65	0.158	-0.011	+	+	0.39	0.10
Bone breaking strenght	[N]	609	173.73	-13.34	*	*	0.72	158

*** P < 0.001; ** P < 0.01; * P < 0.05; + P < 0.10; n.s. P > 0.10

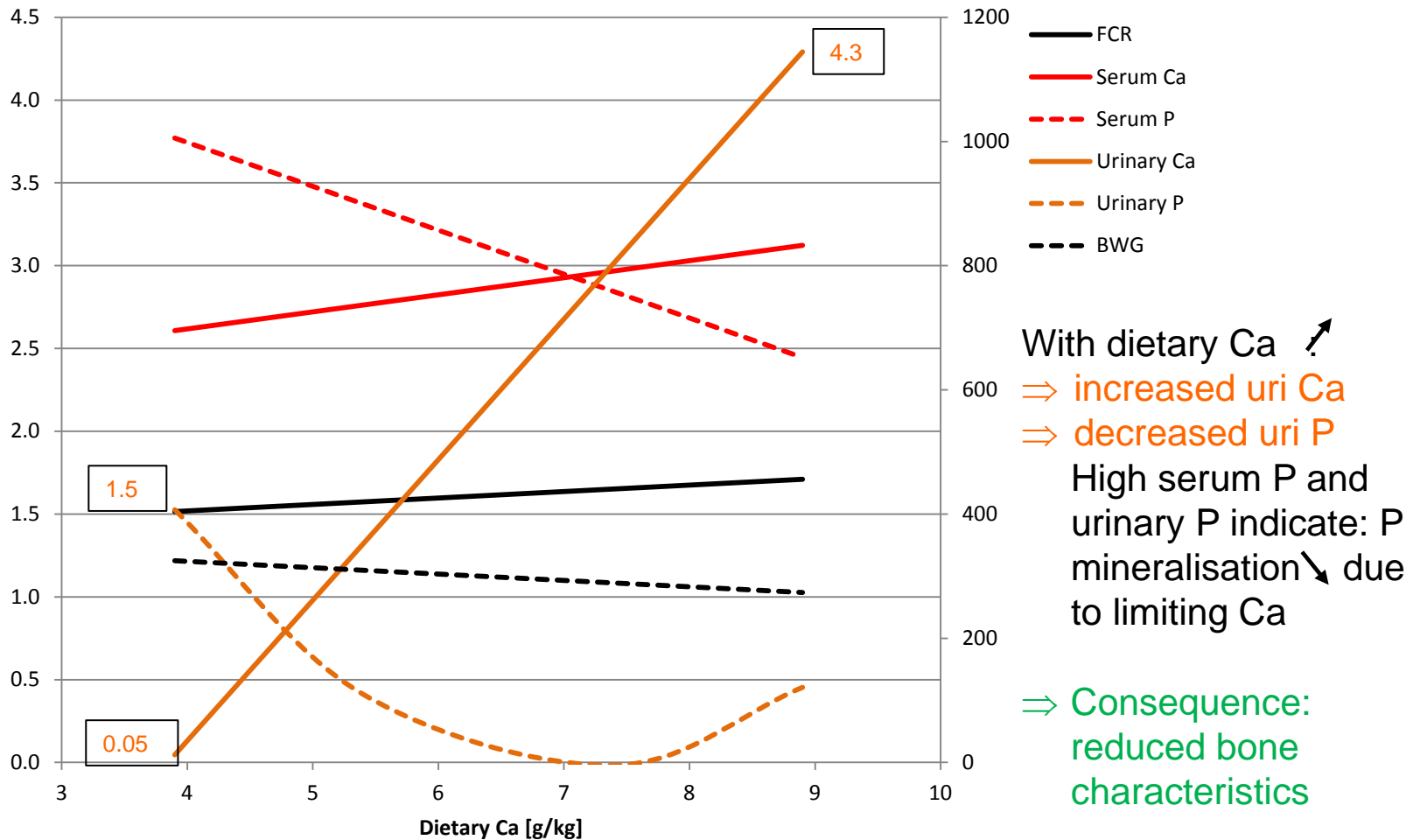
Results



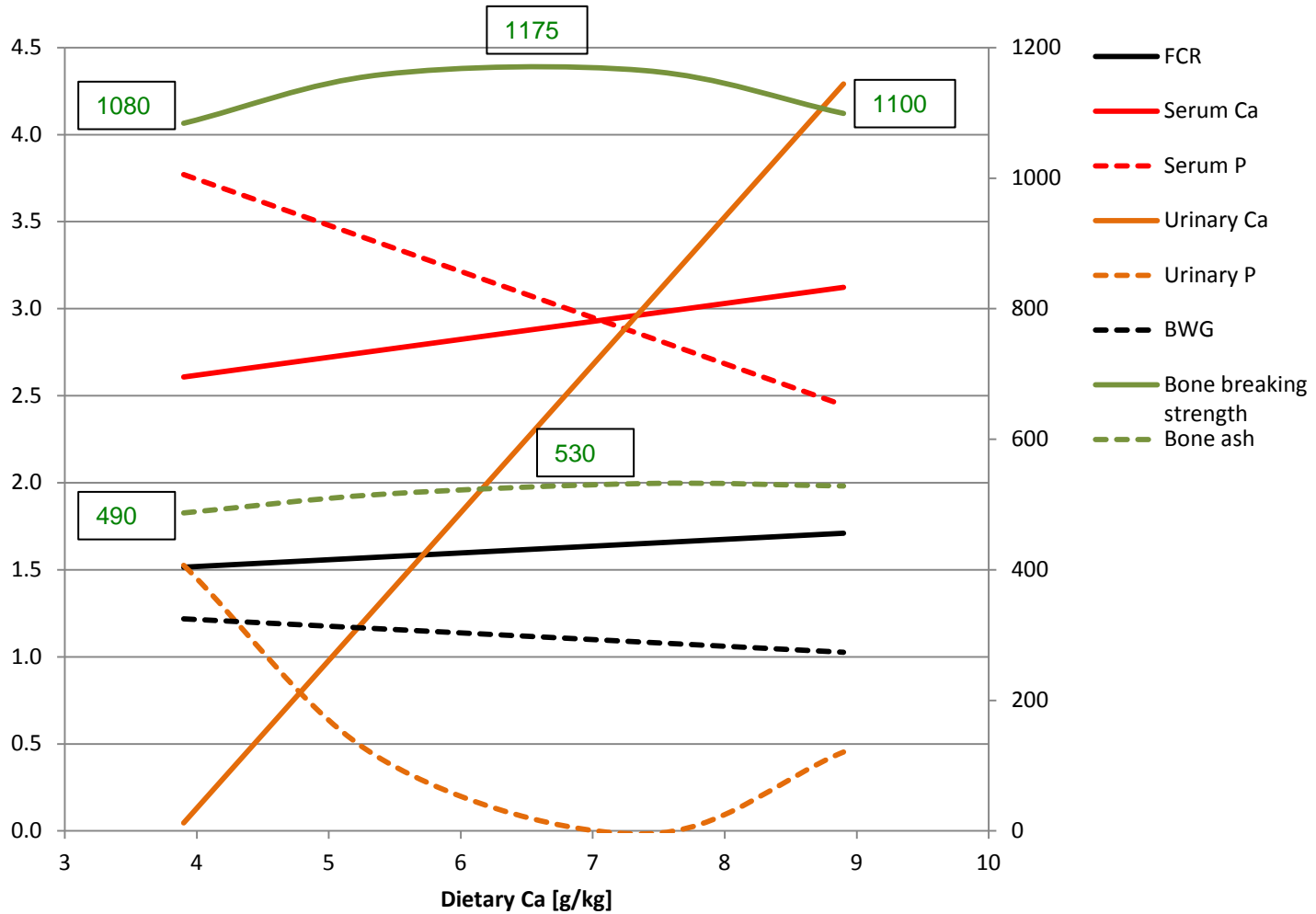
Results



Results



Results



Conclusions

This data illustrates the importance of dietary Ca in optimizing P efficiency when feeding low P diets including exogenous phytase (3 g dP / kg diet)

- **Low dietary Ca (< 5.0 g Ca / kg):** insufficient for optimal P use.

Reason: The absorbed P can't be mineralized due to missing Ca.

Shown with serum P ↑ urinary P ↑ and bone characteristics ↓

- **High dietary Ca (> 8.0 g Ca / kg):** excessive for an optimal P use.

Reason: possibly limited P absorption by complexing in the digestive tract with inorganic P to form insoluble, thus unabsorbable P.

Shown with serum P ↓, urinary P ↓, bone breaking strength ↓ and growth ↓

Conclusions

In low P diets including exogenous phytase (3 g dP / kg), the following critical Ca levels were observed:

Optimal growth:

5.0 – 5.5 g Ca / kg diet (with 3.0 g dP)
Ca : dP of 1.7 – 1.8

Maximal bone characteristics:

6.0 – 7.0 g Ca / kg diet (with 3.0 g dP)
Ca : dP of 2.0 – 2.3

Risk for Ca-deficiency:

< 4.5 g Ca / kg diet (with 3.0 g dP)
Ca : dP of < 1.5

Risk for P-deficiency:

> 8.5 g Ca / kg diet (with 3.0 g dP)
Ca : dP of > 2.8



Thanks !