

Effects of increasing phosphorus and calcium on growth performance and mineral status in weaned piglets

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Introduction

Phosphorus (P) and calcium (Ca) are essential minerals for adequate bone development in pigs.

The aims were 1) to evaluate diets with increasing digestible P (dP) levels and a fix Ca to dP ratio on growth performance and mineral status in weaned piglets; 2) to compare the responses of physical measurement techniques representative for bone mineralization.

Material and methods

- Animals: 56 Swiss Large White piglets (26±1 d, 7.6±1.2 kg BW); 14 blocks according to litter, gender and BW. Grouped housing with automatic individual feed intake recording. Duration: 41 days.
- Diets: *Ad libitum* fed pelleted (<70°C) barley based diet. Including 500 FTU/kg phytase (equiv. 0.16 g dP/100 FTU). Ca to dP ratio set at 2.8:1.
- Treatments: **2.5, 3.5, 4.5** and **5.5** g dP/kg diet using monocalcium phosphate. Dietary Ca levels corrected using calcium carbonate.
- Bone measurements: Mineral contents in metacarpus III and IV; breaking strength, gravimetric density, and dual-energy X-ray absorptiometry (GE, i-DXA) bone mineral content and density on tibia.

Results

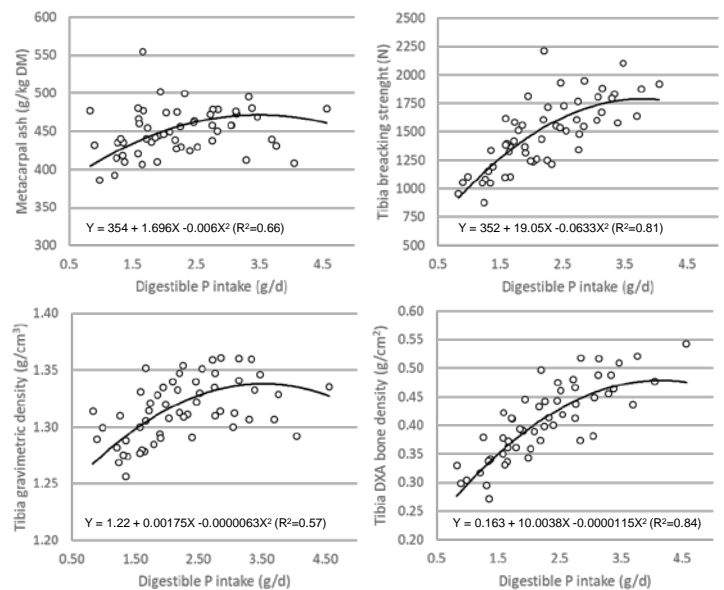
- Growth : Comparable (P>0.10) final BW (22.0, 0.84 kg; *least square mean, SEM*), BWG (345, 18.4 g/d) and FI (561, 26 g/d). Improved (P<0.01) FCR in 2.5 and 3.5 vs. 4.5 and 5.5 g/kg dP (1.58 vs. 1.72).
- Blood serum: Comparable (P>0.10) Ca, P contents and alkaline phosphatase activity.
- Bone mineralisation:

	digestible P [g/kg diet]				SEM	P-value ¹⁾
	2.5	3.5	4.5	5.5		
Metacarpus III and IV						
Ash [g/kg DM]	426 ^c	447 ^b	461 ^{ab}	471 ^a	5.3	***
Zn [mg/kg DM]	139	136	134	129	3.8	n.s.
Tibia²⁾						
Breaking strength [N]	1178 ^b	1507 ^a	1619 ^a	1689 ^a	61.1	***
Gravimetric density [g/cm ³]	1.28 ^c	1.31 ^b	1.33 ^{ab}	1.34 ^a	0.004	***
DXA Bone mineral content [g]	7.3 ^c	9.5 ^b	10.2 ^{ab}	10.9 ^a	0.39	***
DXA Bone mineral density [g/cm ²]	0.33 ^c	0.40 ^b	0.44 ^{ab}	0.46 ^a	0.009	***

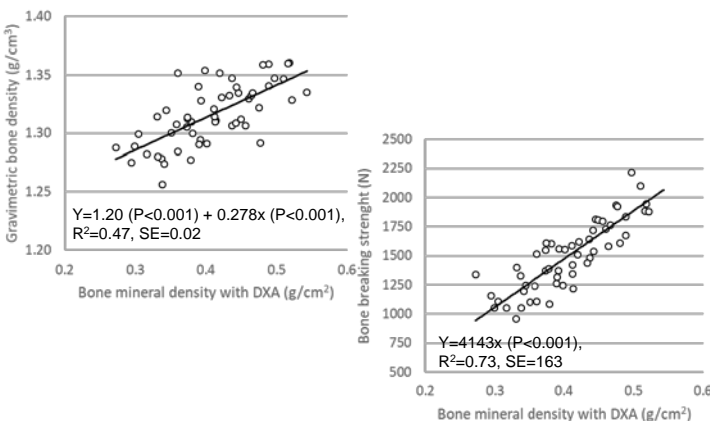
¹⁾ *** P < 0.001; ** P < 0.01; n.s. (non significant) P > 0.10

²⁾ Tibia weight and volume were comparable (P>0.10) between treatments: 51.4 g, SEM = 1.8 g; 39.1 cm³, SEM = 0.6 cm³

Bone mineralisation relative to daily P-intake:



Correlations between tibia physical measurement techniques



Conclusions

- The deteriorated FCR from 4.5 g dP/kg onwards may be due to the excessive dietary Ca.
- 3.5 g dP/kg were optimal as FCR was not deteriorated and bone ash and physical properties were close to maximas
- Metacarpal Zn status was not antagonized by increasing dietary Ca and P.
- The DXA technique was successful to reflect values from more labor intensive measurements, such as bone breaking strength and gravimetric bone density in tibia from piglets.