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Effect of phosphorus and calcium depletion-repletion sequences on femoral mechanical properties in growing pigs.

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Consequences of a P-Ca deficient diet (depletion) or a control diet (repletion) on the mechanical properties of growing pig femurs were studied. Two different groups of pigs were fed with different P-Ca depletion-repletion sequences, that involved a control diet (C) or a deficient diet (L), supplying 100% or 60% of P-Ca requirements, respectively, in an incomplete factorial design. The first group (n = 30; initial BW 24 ± 3.3 kg) received during 2 28-d phases CC, CL or LC dietary treatments. The second group (n = 50; initial BW 24 ± 2.8 kg) received during three 28-d phases CCC, CLC, LCC, LLC or LLL diets. At the end of the 2nd and 3rd phases, respectively, pigs were killed and right femurs collected for computer tomography (CT) scans and mechanical tests. Data were analyzed using Proc Mixed procedures and orthogonal contrasts for treatments interferences. A 28-d repletion period in the 2nd phase (CC, LC) increased (43%, $P = 0.03$) bone-bending moment (BM, kg-mm) compared with depleted pigs (CL). Repletion P-Ca diets in the 3rd phase (CCC, CLC, LCC and LLC) increased BM ($P < 0.01$) and strain ($P = 0.03$) compared with LLL pigs. Moment of inertia (MI, mm⁴) tended to be lower ($P = 0.08$) in depleted animals (LLL) compared with repleted animals, resulting in a reduced ($P = 0.02$) bone stress (kg/mm²) in LLL pigs. However, neither bone MI nor stress differed among treatments. P-Ca depletion at the end of the 2nd or 3rd phase (CL, LLL) reduced bone mechanical properties. No differences were found between CC and LC treatments regarding mechanical properties, which implies bone recovery from P-Ca deficiencies of the 1st phase. Mechanical properties after 3 28-d growing phases (final BW 107 ± 11.3 kg) are shown in the table. Superscripts indicate treatment differences ($P < 0.05$). A 28-d repletion in the 3rd phase (CCC, CLC, LCC or LLC) is sufficient for recovery from previous deficiencies as similar mechanical properties were detected among treatments. Table 1

Item	Trait					SEM
	CCC	CLC	LCC	LLC	LLL	
BM (kg·mm)	3049 ^A	2501 ^A	2527 ^A	2354 ^{AB}	1726 ^B	259
Strain	0.026 ^{AB}	0.027 ^{AB}	0.030 ^A	0.025 ^{AB}	0.023 ^B	0.002
Stress (kg/mm ²)	1.346	1.129	1.170	1.105	0.886	0.123

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