Effects of dietary vitamin D level and calcitriol on plasma mineral concentration and bone traits of piglets

A. Gutzwiller, D. Guggisberg, P. Schlegel
Agroscope Liebefeld-Posieux ALP, CH-1725 Posieux.
andreas.gutzwiller@alp.admin.ch

Introduction: Vitamin D is hydroxylated in the body to 25(OH)-calciferol and then to the active metabolite calcitriol ($1,25(OH)_2$-calciferol) which facilitates the absorption of calcium (Ca), magnesium (Mg) and phosphorus (P) in the small intestine and improves bone mineralisation. In view of the need to maximise dietary P utilisation for ecological as well as for economic reasons, the question arises if high dietary vitamin D levels, as recommended by the feed industry, and vitamin D metabolites improve bone mineralisation, or may on the contrary have negative side effects.

Animals, material and methods: In a tolerance study, increasing amounts of a standardised formulation of dried leaves of the calcitriol containing plant *Solanum glaucophyllum* (Panbonis, Herbonis Animal Health, Basel, Switzerland) were added to the experimental diets which contained per kg 9.7 g Ca, 5.5 g P, 500 FTU phytase and 25 or 50 µg vitamin D_3. The diets supplemented with 0, 2.5, 5, 10 and 20 µg/kg calcitriol were fed to ten Large White piglets per treatment for six weeks, starting at weaning. Thereafter the piglets of four dietary treatments (table 1) were slaughtered, their tibiae were broken using the three point bending test, and the third metacarpal bones were defatted, ashed and analysed using the ICP-MS method.

Results and discussion: Increasing the dietary vitamin D_3 level from 25 to 50 µg/kg (i.e. to 2000 IU/kg, the maximum content authorised in the EU) neither influenced plasma Ca and P concentration ($P > 0.10$) nor the bone traits (table 1). Calcitriol increased the plasma P concentration ($P < 0.05$) during the first three weeks after weaning, i.e. when plasma P concentration was at its lowest concentration. Four to six weeks after weaning, the highest tested calcitriol level (20 µg/kg) increased plasma Ca concentration ($P < 0.05$) up to 3.5 mmol/l, which is a sign of a hypervitaminosis. This calcitriol level also reduced the bone breaking strength by 11% and to a lesser degree affected the bone ash and Mg concentration compared to the control diet 25/0 which contained 25 µg/kg D_3 and no calcitriol ($P < 0.05$; table 1).

Table 1. Dietary effects on the bone traits

Dietary treatment	25/0	50/0	50/10	50/20	SEM	*P*
D_3, µg/kg diet	25	50	50	50		
Calcitriol, µg/kg diet	0	0	10	20		
Breaking strength, N	1724[a]	1753	1656	1540[b]	47	0.02
Ash, g/kg DM	582[a]	580	582	564[b]	5.4	0.09
Ca, g/kg DM	231	232	233	230	3.0	0.92
P, g/kg DM	117	118	118	113	1.3	0.06
Mg, g/kg DM	4.48[a]	4.39	4.24	4.13[b]	0.09	0.03

SEM standard error of means; *P* probability of error (ANOVA); DM dry matter; [a,b] difference ($P < 0.05$) between treatment 25/0 and the corresponding treatment (planned pairwise comparisons)

Conclusion: The results show that the addition of 2.5 µg/kg calcitriol (the dose recommended by the manufacturer of Panbonis) had a positive effect on plasma P concentration during the first weeks after weaning, whereas at the eightfold recommended dose (20 µg/kg calcitriol) negative side effects such as hypercalcemia and reduced bone strength may occur.

ESVCN

European Society of
Veterinary & Comparative
Nutrition

16th ESVCN Congress

13-15 September 2012
Bydgoszcz, Poland