Impact of Calcium and Phosphorus on Sow Lameness and Sow Longevity

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SUMMARY

The current NRC Swine (1998) recommendations for Ca and P feeding levels for gestating sows are primarily based on data for stall housed sows. Additionally, much of the literature on Ca and P requirements is older and may not be relevant to the modern, high producing sow. A trial was conducted to determine if the current recommended feeding levels of Ca and P during gestation are adequate for high producing sows housed in stalls or groups. We found that the current recommendations are adequate for group housed sows in a non-competitive group housed situation. We also observed increased performance in the group setting, with group housed sows giving birth to larger litters and heavier piglets.

INTRODUCTION

Improvements in sow productivity have raised the question of the adequacy of dietary mineral recommendations. The increase in anatomical and physiological demands of the skeletal system has led the feed industry to routinely recommend higher dietary levels of minerals including calcium (Ca) and phosphorus (P). There has been very limited research examining the Ca requirement of the modern, highly prolific sow. It is not known if the Ca requirement has changed to accommodate milk requirements of the larger litter, and/or if the sows are required to mobilize Ca from their bones for milk production. Increased Ca demands could be a potential cause of reduced longevity for our sow herd. Currently, Canadian producers are faced with extremely high feed and housing costs, and reduction in sow longevity leads to increased costs associated with raising replacement gilts.

Welfare of reproducing sows confined in stalls is a concern. Food retailers have been revisiting their purchasing strategies to not include pork from farms with individual stalls.

"Current calcium and phosphorus recommendations are adequate for group housed sows in a non-competitive group housed situation"

Confinement offers no opportunity for movement and it has been proposed that movement is required to maintain bone strength and integrity. Questions have been raised on whether the current recommended levels of Ca and P will be sufficient for animals housed in groups, with the potential for increased mobility.

To help answer these questions, an experiment was conducted to determine the influence of dietary Ca and P levels in the gestation diet of high producing sows housed in stalls or groups on Ca and P balance, productivity and bone turnover.

MATERIALS AND METHODS

The experiment was designed using a 3 x 2 factorial arrangement of treatments. A total of 180 sows were randomly assigned to each treatment group. Three dietary levels of Ca and P were used at an equal ratio; Ca 0.76%: P 0.67% (Control), Ca 0.65%: P 0.57% (-15%) and Ca 0.87%: P 0.77% (+15%). Two different housing strategies

Table 1. The effect of dietary Ca & P (15% variance from 1998 NRC recommendations) and housing on sow body weight changes during gestation and lactation and lactation feed intake

Diet	Housing	Sow's Body Weight and Feed Intake (kg)			
		BW Day 0	BW Day 100	BW Wean	ADFI Total
-15% Ca	Stall	230.6	251.8[a]	238.9	7.00
	Group	232.8	264.2[b]	241.4	7.06
Control Ca	Stall	229.9	260.8[a]	246.4	7.03
	Group	238.5	270.7[b]	253.2	6.52
+15% Ca	Stall	228.4	253.8[a]	233.1	6.76
	Group	241.4	265.9[b]	245.4	6.98
SEM		7.06	5.34	7.10	0.29
Statistical Analysis		P Value			
Diet		0.88	0.33	0.25	0.53
Housing		0.15	0.01	0.21	0.69
Diet*Housing		0.72	0.97	0.79	0.24

Means with the same letter in the same column are not significantly different (P>0.05).

Table 2. The effect of dietary Ca & P (15% variance from 1998 NRC recommendations) and housing on piglets born, weights and average daily gain

Diet	Housing	Piglets data				
		Number Born Live	Total Litter Size	Avg. Birth Weight (kg)	Avg. Wean Weight (kg)	ADG (kg/d)
-15% Ca	Stall	14[a]	15	1.52[a]	6.57	0.22
	Group	15[b]	16	1.62[b]	6.74	0.24
Control Ca	Stall	14[a]	16	1.46[a]	6.56	0.23
	Group	15[b]	15	1.54[b]	6.60	0.23
+15% Ca	Stall	14[a]	16	1.48[a]	6.57	0.23
	Group	16[b]	17	1.59[b]	6.84	0.23
SEM		0.59	0.56	0.06	0.19	0.01
Statistical Analysis				P Value		
Diet		0.60	0.09	0.42	0.66	0.99
Housing		0.03	0.40	0.02	0.40	0.55
Diet*Housing		0.54	0.61	0.94	0.92	0.29

Means with the same letter in the same column are not significantly different (P>0.05).

were used; individual stalls and group (modified free access housing). Free access housing ("walk-in lock-in" stalls) allows sows access to feed in a non-competitive environment, however they can leave the stall when desired. To accommodate the experiment, these sows were locked in for individual, controlled feeding and then forced out of their stalls into a group pen for the remainder of the day. Treatment groups were balanced across parities.

Sows began consuming treatment diets 4 to 5 weeks post-breeding. They were fed 2.3 kg per day as per normal barn practice. Water was available in stalls and in the group areas. Sows were moved into a farrowing room 1 week prior to expected farrowing. Sows were weighed when they entered gestation, farrowing and weaning (day 28 of lactation). Piglets were weighed 3 days post-birth and at weaning.

Feed and fecal samples were obtained in gestation and lactation to allow estimation of Ca balance. Milk and blood samples were analysed for Ca and P. Blood was also analysed for biomarkers indicative of bone mobilization. A sub-sample group of sows were equipped with activity monitors and were video-taped to allow estimation of activity.

RESULTS AND DISCUSSION

Sows housed in groups were heavier at day 100 of gestation than those in stalls, despite no difference in feed intake ($P < 0.05$; Table 1). Moreover, sows housed in groups had larger litter size and heavier piglets ($P < 0.05$; Table 2). Diet had only modest effects on production parameters, however there was an apparent diet by housing interaction for serum calcium at day 100 of gestation

Table 3. The effect of dietary Ca & P (15% variance from 1998 NRC recommendations) and housing on sow serum calcium and phosphorus levels

Diet	Housing	Serum Calcium (mmol/L)				Serum Phosphorus (mmol/L)			
		Day 0	Day 100	Mid-Lac	Wean	Day 0	Day 100	Mid-Lac	Wean
-15% Ca	Stall	2.47	2.33[a]	2.46	2.43	2.23	2.15[a]	2.11	2.19
	Group	2.40	2.18[b]	2.43	2.39	2.20	2.05[b]	2.01	2.07
Control Ca	Stall	2.44	2.28[ab]	2.43	2.40	2.27	2.14[a]	2.17	2.14
	Group	2.41	2.31[ab]	2.44	2.39	2.13	2.13[b]	2.14	2.18
+15% Ca	Stall	2.43	2.35[a]	2.46	2.40	2.21	2.21[a]	2.18	2.25
	Group	2.41	2.32[a]	2.47	2.39	2.14	2.11[b]	2.18	2.14
SEM		0.046	0.037	0.028	0.031	0.051	0.041	0.060	0.057
Statistical Analysis		P Value				P Value			
Diet		0.88	0.05	0.34	0.72	0.65	0.32	0.21	0.48
Housing		0.10	0.06	0.62	0.36	0.03	0.02	0.65	0.16
Diet*Housing		0.68	0.02	0.58	0.70	0.39	0.38	0.80	0.21

Means with the same letter in the same column are not significantly different (P>0.05).

where serum Ca was low in sows fed the low Ca diet, but only in sows housed in groups (Table 3). This could be a result of increasing fetal weight, since they also had more piglets born. Serum P showed similar tendencies when diet Ca:P ratio remained similar (Table 3).

CONCLUSION

We conclude that current NRC recommendations for dietary Ca and P for gestating sows is adequate regardless of housing. Moreover, in this study, housing in groups during gestation improved sow production, as indicated by increased litter size. Sows were not required to compete for food in our housing system, which may be a concern with some group housing systems and should be taken into consideration if reductions in performance are observed.

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