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The effects of additional niacin during gestation and lactation on sow and litter performance

Abstract

Sixty first-litter sows were utilized to evaluate the effects of additional niacin on sow and litter performance through two parities. The control diet provided sows with 50 mg niacin daily during gestation and 100 mg niacin daily during lactation. Dietary treatments were formulated to provide sows with either 5 or 10 times the level of supplemental niacin in the control diet. Litter size was equalized within dietary treatment by 24 hr after farrowing. During the first parity, sows fed additional niacin tended to have fewer total pigs born and pigs born alive (linear effect of niacin P<.10). In addition, sows fed additional niacin had fewer pigs equalized/litter (linear P(.05 and quadratic P<.06 effect of niacin), but tended to wean more pigs/litter and had a 6% greater pig survival rate than those fed the control diet. Average pig birth wt increased linearly (P<.05) as level of added niacin increased. Also, average pig wt and Litter wt at weaning were numerically higher for sows fed additional niacin during lactation. Sows fed the 250/500 mg/d niacin gestation-lactation sequence had more backfat on d 108 of gestation (quadratic effect of niacin, P<.05), but also lost more backfat during lactation (quadratic effect of niacin, P<.05).; Swine Day, Manhattan, KS, November 20, 1986

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THE EFFECTS OF ADDITIONAL NIACIN DURING GESTATION AND LACTATION ON SOW AND LITTER PERFORMANCE

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Summary

Sixty first-litter sows were utilized to evaluate the effects of additional niacin on sow and litter performance through two parities. The control diet provided sows with 50 mg niacin daily during gestation and 100 mg niacin daily during lactation. Dietary treatments were formulated to provide sows with either 5 or 10 times the level of supplemental niacin in the control diet. Litter size was equalized within dietary treatment by 24 hr after farrowing.

During the first parity, sows fed additional niacin tended to have fewer total pigs born and pigs born alive (linear effect of niacin P<.10). In addition, sows fed additional niacin had fewer pigs equalized/litter (linear P<.05 and quadratic P<.06 effect of niacin), but tended to wean more pigs/litter and had a 6% greater pig survival rate than those fed the control diet. Average pig birth wt increased linearly (P<.05) as level of added niacin increased. Also, average pig wt and litter wt at weaning were numerically higher for sows fed additional niacin during lactation. Sows fed the 250/500 mg/d niacin gestation-lactation sequence had more backfat on d 108 of gestation (quadratic effect of niacin, P<.05), but also lost more backfat during lactation (quadratic effect of niacin, P<.05).

During the second parity, additional niacin had no effect on number of total pigs born, number born alive, pig birth wt, number weaned/litter, or pig survival to weaning. However, pig wt and litter wt at weaning were again numerically higher for sows fed additional niacin. Sow backfat change during gestation or lactation was not affected by supplemental niacin. Sows fed the 250/500 mg/d niacin gestation-lactation sequence tended to lose less weight during lactation than those fed the control or the 500/1000 mg/d niacin sequence.

These results suggest that first-litter sows fed additional niacin during gestation and lactation tended to have fewer pigs born and pigs born alive. However, these sows also tended to have heavier pigs at birth and increased pig survival (6%), and weaned slightly heavier pigs than those fed 50 mg/d niacin during gestation and 100 mg/d niacin during lactation.

Introduction

As greater productivity demands are placed on the sow, nutrient levels of the diet must be increased so as not to limit sow performance. Through the course of several parities, a sow must often rely upon her own body reserves for providing nutrients during peak production periods like lactation, then must replenish these reserves during gestation. However, the sow is not able to accumulate large quantities of B-complex vitamins, and must meet these requirements daily by way of the diet or by microbial synthesis in the large intestine. These B-vitamins play key roles as cofactors in various metabolic pathways, therefore, a slight deficiency of one of these vitamins would seriously limit sow productivity. Little research has been conducted concerning the niacin requirements of sows. Niacin has been shown to increase milk yield in dairy cattle, as well as function as a cofactor in lipid, carbohydrate, and protein metabolism. The objective of this study was to evaluate the effects of feeding additional niacin during gestation and lactation on sow and litter performance.

Experimental Procedures

Sixty gilts were assigned at breeding to one of three gestation-lactation treatments. Control sows were fed a corn-soybean meal diet (14% crude protein) that provided 50 mg/d niacin during gestation and 100 mg/d niacin during lactation (Table 1). Additional niacin was then added to provide sows with either 250/500 or 500/1000 mg/d niacin during gestation and lactation, respectively. All sows were fed 4 lbs/d from breeding until day 90 of gestation, at which time feed was increased to 5 lbs/d until farrowing. On day 108 of gestation, all sows were moved into the farrowing house, sow weight was recorded, and backfat was measured ultrasonically[1]. Following parturition, sows were fed 9 lbs/d of a lactation diet.

Sow and pig weights were recorded within 24 hours following parturition and litters were standardized within each dietary treatment. Sow and pig weights were recorded on day 14 of lactation and at weaning (day 21). Sow backfat was also measured at weaning.

Following weaning, sows were moved into individual gestation stalls and checked once daily for estrus with a boar. Estrous detection continued for a maximum of 30 days postweaning, at which time any sow not showing estrus was slaughtered and her reproductive tract examined. For the second parity, sows were maintained on the same gestation-lactation treatments previously assigned and all experimental procedures were similar to parity one.

In the statistical analysis of the data, the number of pigs/litter after equalization was used as a covariate for sow and litter performance during lactation. This allowed for lactational criteria to be evaluated on an equal pig/litter basis.

Results and Discussion

The effects of niacin intake during gestation and lactation on sow and pig performance (parity 1) is presented in Tables 2 and 3. Control sows tended to have more total pigs born and pigs born alive than those sows fed additional niacin (linear effect of niacin $P<.10$). Number of pigs/litter after equalization was also decreased as level of niacin increased (linear $P<.05$ and quadratic $P<.06$ effect of niacin). This was a result of sows fed added niacin having fewer pigs born alive. Although having fewer pigs equalized/litter, sows fed 500 or 1000 mg/d niacin

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[1]Technicare 210DX, Johnson & Johnson Co.

during lactation weaned slightly more pigs than control sows, as a result of a 6% improvement in pig survival to weaning. As level of additional niacin increased, there was a linear increase in pig birth wt (P<.05). However, this also might have been result of fewer pigs born and the negative correlation between number born alive and birth wt. In addition, sows fed added niacin had numerically heavier pig and litter wts at weaning.

Sows fed 250/500 mg/d niacin gestation-lactation sequence had more backfat on day 108 of gestation than those fed the control or 500/1000 mg/d niacin gestation-lactation sequence (quadratic effect of niacin, P<.05). However, sows fed 250/500 mg/d niacin also tended to lose more backfat during lactation (quadratic effect of niacin, P<.05). Since all sows had the same daily feed intake, this change in backfat during lactation might have been a result of greater milk production, as shown by the slightly heavier pig and litter wts at weaning. Feeding added niacin had no effect on percentage of primiparous sows in estrus by 7 or 14 days postweaning.

The effects of additional niacin intake during gestation and lactation (parity 2) is presented in Tables 4 and 5. There were no adverse affects of additional niacin on number of total pigs born or number born alive. In addition, pig birth wt, survival to weaning, and pigs weaned per litter were not affected by supplemental niacin. However, sows fed additional niacin tended to have numerically heavier pig and litter wts at weaning.

Sows fed 500 mg/d of niacin tended to gain more weight during the second gestation; however, they also tended to lose more weight during lactation. Sows fed 250/500 mg/d niacin gestation-lactation sequence lost the least weight during lactation. Added niacin had no effect on percentage of sows returning to estrus by 7 or 14 days (parity 2).

Research with dairy cattle has shown an increase in total milk yield and fat content for cows feed supplemental niacin. The exact metabolic process of how niacin improves milk yield is not known, but researchers feel that supplemental niacin may increase the level of NAD/NADP coenzymes, allowing for increased protein, carbohydrate, and lipid metabolism. Niacin may also increase milk production by elevating plasma glucose and preventing excessive fat mobilization (subclinical ketosis), thus allowing the liver to efficiently utilize normal plasma lipid levels.

The results of this study suggest a tendency for higher pig survivability for primiparous sows fed additional niacin. Furthermore, sows fed additional niacin weaned slightly heavier pigs. These effects may be the result of improved milk production for sows fed added niacin. From the wide range of niacin levels used in this experiment, it is difficult to determine an optimum daily requirement; however, from sow and litter performance it would appear to be between the 250/500 and 500/1000 mg/d niacin gestation-lactation sequences.

It is evident that further research is required to determine the optimal level of niacin addition in gestation/lactation diets for maximum sow and litter performance.

Table 1. Composition of Diets.

Ingredients, %	Gestation I[a]	Gestation II[b]	Lactation[c]
Corn[d]	80.45	86.17	75.48
Soybean meal (44%)	15.55	10.45	19.90
Dicalcium phosphate (21%)	2.05	1.50	2.25
Limestone	1.10	.95	1.25
Salt	.50	.45	.50
Vitamin premix[e]	.25	.20	.22
Trace mineral premix[f]	.10	.08	.10
Furox (50g/lb)	—	.20	.20
Biotin (100mg/lb)	—	—	.10
	100.00	100.00	100.00

[a]Fed from d 0-90 of gestation at 4 lbs/d providing 50 mg niacin/sow/day.
[b]Fed from d 90-114 of gestation at 5 lbs/d providing 50 mg niacin/sow/day.
[c]Fed during lactation at 9 lbs/d providing 100 mg niacin/sow/day.
[d]Corn was replaced by niacin to provide 250 or 500 mg niacin/sow/day during gestation, and 500 or 1000 mg niacin/sow/day during lactation.
[e]Each lb of premix contains the following: vitamin A, 800,000 IU; vitamin D_3, 60,000 IU; vitamin E, 4000 IU; riboflavin, 900 mg; menadione, 310 mg; pantothenic acid, 2400 mg; niacin, 5000 mg; choline chloride, 92,200 mg; vitamin B_{12}, 4.4 mg.
[f]Containing 10.0% Mn, 10% Fe, 1.0% Cu, 10% Zn, 0.30% I, and 0.3% Co.

Table 2. Effect of Niacin Intake during Gestation and Lactation on Pig Performance (Parity 1).[a]

	Niacin Intake mg, Gestation/Lactation		
Item	50/100	250/500	500/1000
No. of litters	20	18	22
Total pigs born[b]	11.3	9.6	9.9
Pigs born alive[b]	10.0	9.1	8.7
Pigs/litter after equalization[cd]	9.7	8.8	8.7
Survival to weaning, %	82.7	88.9	86.5
Pigs weaned/litter	7.5	8.0	7.8
Pig Performance, lbs			
Pig birth wt[c]	2.51	2.60	2.84
Litter birth wt	24.8	23.1	24.2
Pig wt at weaning	10.2	10.9	11.0
Litter wt at weaning	76.9	87.2	84.4

[a]Lactation length, 21 days.
[b]Linear effect of niacin (P<.10).
[c]Linear effect of niacin (P<.05).
[d]Quadratic effect of niacin (P<.06).

Table 3. Effect of Niacin Intake during Gestation and Lactation on Sow Backfat, Weight Changes, and Percentage of Sows in Estrus Postweaning (Parity 1).[a]

	Niacin Intake mg, Gestation/Lactation		
Item	50/100	250/500	500/1000
No. of sows	20	18	22
Sow wt gain during gestation, lbs	101.7	101.2	108.2
Sow backfat change during gestation, in	-.03	.03	-.06
Sow wt d 108 gestation, lbs	358.4	356.9	359.3
Sow backfat d 108 gestation, in[b]	.85	.91	.78
Sow wt change during lactation, lbs	-15.5	-16.1	-15.0
Sow backfat change during lactation, in[b]	-.05	-.12	-.01
Percentage of sows in estrus by:			
7 days after weaning	95.0	100.0	86.4
14 days after weaning	100.0	100.0	95.4

[a]Lactation length, 21 days.
[b]Quadratic effect of niacin ($P<.05$).

Table 4. Effect of Niacin Intake during Gestation and Lactation on Pig Performance (Parity 2).[a]

	Niacin Intake mg, Gestation/Lactation		
Item	50/100	250/500	500/1000
No. of litters	18	15	18
Total pigs born	9.6	9.9	9.2
Pigs born alive	8.7	9.2	8.4
Pigs/litter after equalization[b]	8.6	9.2	8.2
Survival to weaning, %	96.3	95.6	98.5
Pigs weaned/litter	8.2	8.2	8.5
Pig Performance, lbs			
Pig birth wt	3.54	3.41	3.43
Litter birth wt	30.0	31.0	27.8
Pig wt at weaning	11.4	11.8	12.1
Litter wt at weaning	95.3	96.3	100.7

[a]Lactation length, 21 days.
[b]Quadratic effect of niacin ($P<.05$).

Table 5. Effect of Niacin Intake during Gestation and Lactation on Sow Backfat, Weight Changes, and Percentage of Sows in Estrus Postweaning (Parity 2).[a]

	Niacin Intake mg, Gestation/Lactation		
Item	50/100	250/500	500/1000
No. of sows	18	15	18
Sow wt gain during gestation, lbs	90.5	91.1	98.4
Sow backfat change during gestation, in	+.04	+.06	+.02
Sow wt. d 108 gestation, lbs	410.9	404.8	414.0
Sow backfat d 108 gestation, in	.83	.87	.81
Sow wt change during lactation, lbs	-22.3	-16.8	-27.3
Sow backfat change during lactation, in	-.19	-.22	-.16
Percentage of sows showing estrus by:			
7 days after weaning	61.1	86.7	72.2
14 days after weaning	100.0	100.0	94.4

[a]Lactation length, 21 days