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Effect of nutrient deletion from lactation diets on feed consumption and weight change of sows intended to be culled and on litter performance during lactation and subsequent nursery phase

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Sows that are destined to be culled from the herd need only produce milk to support adequate litter growth during the last lactation and need not maintain nutrient stores to support subsequent reproduction processes. Most reduction in lactation performance has been associated with nutrient deficiencies during the gestation period, not nutrient deficiencies during lactation. Supplemental sources of trace minerals, vitamins, and calcium (Ca) and phosphorus (P) add cost to the lactation diet. If lactation performance is not affected by nutrient reduction, considerable feed savings could be realized for sows to be culled.

Pig performance after weaning is also of concern. Pigs with heavier weights within a weaning group tend to maintain heavier weights in subsequent growth periods. However, pigs that have lighter weights due to nutrient deficiencies tend to exhibit compensatory growth in subsequent growth periods. If weaning weight is affected by nutrient reduction in the lactation diet, evaluation of subsequent pig performance is important.

Detrimental effects of nutrient deficiencies on return to estrus after weaning need to be documented to demonstrate the importance of proper nutrition for sows intended to remain in the reproduction pool. Also of concern is the weight of the sow at selling time and its effect on salvage value.

(Key Words: Lactating sows, Nutrient deletion, Weaned pig performance.)

Experimental Procedure

Fifty-six sows from three farrowing groups, destined to be culled after weaning, were assigned to one of three lactation diets at parturition based on parity (fifth to 10th) and weight. Sows were confined in farrowing crates over vinyl slatted or vinyl covered wire mesh

raised floors. The room was maintained at 18°C for sow comfort and heat pads provided additional zone heat for pig comfort. Pigs were cross-fostered between sows within the first 24 hours after farrowing to provide a minimum of nine pigs per litter.

Sows received 1.8 kg per day of a standard, nutrient-adequate gestation diet until parturition. They then received one of three lactation diets provided ad libitum (Table 1).

The diets were:

- CON = Control diet with full complement of nutrients required for lactation
- DEF = Diet without supplemental vitamins, trace minerals and Ca and P
- DEF+ = Diet without supplementary vitamins and trace minerals.

Sow feed consumption and sow weight during the 21-day lactation was recorded. Initial and 21-day pig weights were obtained to calculate litter performance during lactation. Pig survival rate was calculated.

Pigs were weaned in groups of litters as they reached 21 to 27 days of age and housed in a modern nursery. Nursery room temperature was 32°C at the beginning of the nursery phase and was reduced by 2°C each week. Individual litters were divided into heavy and light groups that were penned separately. Pigs were fed a commercial phase I diet (2 kg/pig) followed by a commercial phase II diet to the end of the nursery phase. Pig weights and feed consumption were recorded over the 28-day nursery period. Pig survival in the nursery was calculated.

After weaning, sows were heat checked daily with a boar to determine days to return to estrus.

TABLE 1. COMPOSITION OF LACTATION DIETS (%)

Item	Lactation diets ^a		
	CON	DEF	DEF+
Ground corn	70.57	74.40	71.11
Soybean meal, 44%	25.27	25.10	25.23
White salt	.50	.50	.50
Dicalcium phosphate	2.42	—	2.41
Limestone	.74	—	.75
TM-vitamin premix	.50	—	—
Total	100.0	100.0	100.0

^aCON = control diet with full complement of nutrients required for lactation. DEF = diet without supplemental vitamins, trace minerals, and Ca and P. DEF+ = diet without supplementary vitamins and trace minerals.

Sow and litter data collected during lactation were analyzed as a randomized block design with main effects of farrowing group, lactation treatment, and block within farrowing group included in the model. The sow and litter were the experimental unit. Nursery data were analyzed as a randomized block design with the main effects of farrowing group, lactation treatment, block within farrowing group, and weight groups within litter included in the model. The individual pen of pigs (two/litter) was the experimental unit.

Results

The effect of nutrient deletion from lactation diets on sow feed intake, weight change and time for return to estrus are shown in Table 2. No differences in feed intake ($P>.10$) were observed due to lactation treatment. Daily feed intake for the 21-day lactation period ranged from 6.7 kg to 7.0 kg. This is well above the level deemed adequate for maximum milk production. Sows receiving each lactation diet gained weight during lactation with no differences ($P>.10$) observed due to treatment. Lactation gain ranged from 9.4 to 11.9 kg. There was no indication that feeding sows diets devoid of supplemental vitamins, trace minerals, and Ca and P had any effect on sow appetite or ability to maintain body weight.

Days for sows to return to estrus were delayed ($P<.05$) by nutrient deletion. Sows receiving CON with the full complement of vitamins, trace minerals, and macro-minerals returned to estrus in 4.9 days, while sows receiving DEF+ void of supplemental vitamins and trace minerals or DEF void of supplemental vitamins, trace minerals and supplemental Ca

and P required 5.7 and 5.9 days to return to estrus, respectively. As expected, deletion of supplemental vitamins and trace minerals from lactation diets potentially lowered subsequent reproductive efficiency.

The effect of nutrient deletion from lactation diets on pig performance and pig survival to weaning is summarized in Table 3. Although cross-fostering of pigs had occurred in the first 24 hours after birth, litter size was not standardized and there was a difference ($P<.01$) in initial litter size (CON sows had larger litters). At 21 days, there was no difference ($P>.10$) in litter size. Survival rate was similar ($P>.10$) for the pigs nursing the two groups of sows receiving DEF and DEF+ and higher ($P<.05$) than for pigs nursing sows receiving CON. It is unexpected for lower pig survival to be associated with adequate nutrient supplementation, but lower survival rate is generally expected in larger litters. Final litter size at the end of lactation ranged from 8.6 to 9.1 pigs. Total litter weight at the beginning and end of the 21-day lactation period was unaffected ($P>.10$) by nutrient adequacy of the lactation diets. Because of the difference in initial litter size, initial individual pig weights were lower ($P<.05$) for pigs from sows fed CON. At 21 days, pig weights were similar ($P>.10$) for pigs in all experimental groups. No evidence was found that would indicate that lactation performance was negatively affected by not supplementing vitamins, trace minerals, and Ca and P to the sow's lactation diet.

Table 4 summarizes pig performance and survival after weaning for the 28-day nursery period. Each litter was divided into two groups, heavy and light, and fed separately. Statistical

TABLE 2. EFFECTS OF DELETION OF NUTRIENTS FROM LACTATION DIETS ON SOW FEED CONSUMPTION, WEIGHT CHANGE, AND DAYS TO RETURN TO ESTRUS

Item	Lactation diets ^a			SD
	CON	DEF	DEF+	
No. of sows	19	18	19	
Sow feed intake, kg				
Total	146.8	140.0	141.9	22.4
Daily	7.0	6.7	6.8	1.1
Sow weights, kg				
Farrowing	219.6	228.2	226.2	26.0
21 days	231.5	237.6	237.6	22.5
Change	11.9	9.4	11.4	13.3
Return to estrus, days ^b	4.9	5.9	5.7	1.2

^aCON = control diet with full complement of nutrients required for lactation. DEF = diet without supplemental vitamins, trace minerals, and Ca and P. DEF+ = diet without supplementary vitamins and trace minerals.

^bP<.05 Return to estrus was delayed for sows receiving DEF and DEF+.

TABLE 3. EFFECTS OF DELETION OF NUTRIENTS FROM LACTATION DIETS ON LITTER PERFORMANCE AND PIG SURVIVAL TO WEANING

Item	Lactation diets ^a			SD
	CON	DEF	DEF+	
No. of litters	19	18	19	
Litter size				
Initial ^{bc}	11.1	9.3	10.2	1.4
21 days	9.1	8.6	9.1	1.5
Pig survival, % ^c	82.6	93.4	90.3	11.2
Litter weight, kg				
Initial	13.9	14.0	14.6	2.8
21 days	55.1	55.7	56.0	9.6
Change	41.2	41.7	41.4	13.2
Pig weights, kg				
Initial ^c	1.26	1.51	1.44	.25
21 days	6.03	6.54	6.23	1.06

^aCON = control diet with full complement of nutrients required for lactation. DEF = diet without supplemental vitamins, trace minerals, and Ca and P. DEF+ = diet without supplementary vitamins and trace minerals.

^bLitter size was adjusted to ensure more than nine pigs per litter but was not standardized.

^cP<.05. CON differed from both DEF and DEF+.

TABLE 4. EFFECTS OF DELETION OF NUTRIENTS FROM LACTATION DIETS ON PERFORMANCE AND SURVIVAL OF WEANED PIGS TO 28 DAYS POST-WEANING

Item	Lactation diets ^a			SD
	CON ^b	DEF	DEF+	
No. of litters	18	18	19	
No. of pigs				
Initial	164	155	174	
Final	163	151	174	
Nursery survival, %	99.3	97.4	100.0	
Litter weights, kg				
Weaning	62.7	58.5	58.8	13.0
28 days	164.2	159.9	160.0	34.0
Change	101.5	101.4	101.2	23.2
Pig performance				
Avg daily gain, kg	.43	.45	.43	.06
Avg daily feed, kg	.56	.58	.56	.09
Gain/feed	.76	.78	.78	.05

^aCON = control diet with full complement of nutrients required for lactation. DEF = diet without supplemental vitamins, trace minerals, and Ca and P. DEF+ = diet without supplementary vitamins and trace minerals.

^bOne late weaned litter was not included in the CON nursery group.

analysis revealed no interaction ($P > .10$) between weight groups and previous lactation diet fed to the sows. Thus, only total litter information is presented.

Survival rate for all groups was high, ranging from 97.4 to 100%. Litter weights at weaning and at the end of the 28-day nursery period were similar ($P > .10$) among experimental groups. Total litter gain ranged from 101.2 to 101.5 kg ($P > .10$). Feed intake, pig weight gain, and feed conversion were not different ($P > .10$) among treatment groups and were at a desirable level. There was no indication that feeding sows a diet void of supplemental vitamins and trace minerals or void of those nutrients and supplemental Ca and P had any effect on subsequent nursery pig performance.

Summary

Fifty-six sows (fifth to 10th parity) from three farrowing groups were assigned to one of three lactation diets at parturition; a control diet with a full complement of nutrients required for lactation, a diet without supplemental vitamins, trace minerals, and Ca and P, and a diet without supplementary vitamins and trace minerals. Sow feed consumption and weight change were

recorded and litter performance and pig survival rate during the 21-day lactation were obtained.

Pigs were weaned in groups of litters as they reached 21 to 27 days of age and individual litters divided into heavy and light groups and penned separately. Pig weights, feed consumption, and pig survival were recorded over the 28-day nursery period. After weaning, sows were heat checked daily with a boar to determine days to return to estrus.

No differences in feed intake were observed. Daily feed intake for the 21-day lactation period ranged from 6.7 kg to 7.0 kg. Each group of sows gained weight during lactation with no differences observed due to treatment. Lactation gain ranged from 9.4 to 11.9 kg.

Days for sows to return to estrus were delayed from 4.9 days for sows receiving CON to 5.7 and 5.9 days for sows receiving DEF and DEF+, respectively.

There was a difference in initial litter size after parturition, but there was no difference in litter size at 21 days ranging from 8.6 to 9.1 pigs. Total litter weights at the beginning and end of the 21-day lactation period were unaffected by nutrient adequacy of the lactation diets. At 21

days, average pig weights were similar for all treatment groups.

Post-weaning survival rate for all groups of pigs during the nursery period was high, ranging from 97.4 to 100%. Litter weights at weaning and at the end of the 28-day nursery period were similar among experimental groups. Total litter gain ranged from 101.2 to 101.5 kg. Feed intake, pig gain, and feed conversion were not different among treatment groups.

There was no indication that feeding sows a lactation diet void of supplemental vitamins and trace minerals or void of those nutrients and supplemental Ca and P had any effect on sow appetite or weight change, pig survival or performance to weaning, or nursery pig performance. A delay in time to return to estrus after weaning was observed for sows receiving nutrient-deficient diets.

Implications

Sows intended to be sold to slaughter after weaning can be fed nutrient deficient lactation diets without apparent detrimental effects on sow feed intake or weight change and on pig performance during lactation or post-weaning. The practice of not supplementing vitamins, trace minerals, and Ca and P to the lactation diet could result in significant feed cost savings.

Inadvertent or planned use of nutrient deficient lactation diets for sows kept for subsequent reproduction may be costly. The observed longer period to return to estrus would suggest that subsequent reproductive efficiency may be jeopardized by feeding lactation diets not adequately supplemented with vitamins, trace minerals, and Ca and P.