EFFECTS OF LACTATION FEED INTAKE AND CREEP FEEDING ON SOW AND PIGLET PERFORMANCE

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Summary

A total of 84 sows (PIC, Line 1050) and their litters were used to determine the effects of lactation and creep feeding on sow and piglet performance. Three groups of sows were blocked according to day of farrowing and parity and allotted to four treatments in a 2 × 2 factorial with lactation feed intake (*ad libitum* vs. restricted) and creep feeding (none vs. creep) as factors. Piglets were cross-fostered within each block to standardize litter weights and litter size (>11 pigs). A common lactation diet (1,586 kcal ME/lb, 0.97% TID Lys) was used in the study. From d 3 of lactation, *ad libitum* sows were allowed free access to feed while restricted sows were fed 25% less than those fed *ad libitum*. A pelleted creep diet (1,585 ME/lb, 1.56% TID Lys) with 1.0% chromium oxide was offered to creep-fed pigs from d 3 to weaning (d 21). Piglets were weighed individually at d 3, 7, 14, and 21. Amount of creep feed consumed was determined daily. Fecal samples from all creep-fed pigs were taken on d 7, 14, and 21 and fecal color was assessed to categorize pigs as eaters or non-eaters. Sow weight and P2 backfat thickness (6.5 cm from the midline over the last rib) were measured after farrowing and at weaning. There was no interaction between lactation feed intake and creep feeding. *Ad libitum* feeding of sows reduced BW loss (-33.0 vs. -52.9 lb; *P*<0.01), improved total (*P*<0.04) and daily (*P*<0.04) gains of litters, and increased (90 vs. 71%; *P*<0.03) the percentage of sows returning to estrus by d 14 compared with limit-fed sows. Creep feeding did not affect (*P*>0.30) sow BW and backfat loss, but increased days to estrus (5.4 vs. 4.9 d; *P*<0.03) for sows that returned to heat by 14 d. Creep feeding tended to improve litter weaning weights (132.7 vs. 124.9 lb/d; *P*<0.09) by reducing mortality rate after cross-fostering (3.9 vs. 7.3%; *P*<0.06). Total creep feed intake of litters did not differ (2.24 vs. 2.28 lb/litter; *P*<0.93) between *ad libitum* and limit-fed sows. About 60% of the creep-fed pigs were categorized as eaters. Of those identified as eaters, 23, 20, and 57% began consuming creep feeding from d 3 to 7, 7 to 14, and 14 to 21, respectively. From d 0 to 28 post-weaning, there was no effect of creep feeding on d 28 weights (*P*<0.93), ADG (*P*<0.86), ADFI (*P*<0.93), and F/G (*P*<0.95) compared to non-creep fed pigs. Eaters tended to be heavier until d 28 post-weaning (*P*<0.16) and had greater (*P*<0.06) ADG and total gains than non-eaters and no creep pigs. In conclusion, creep feeding improved survivability, but had no effects on pre-weaning gain and sow performance. Low feed intake during lactation negatively affected both sow and litter performance. Creating more eaters in whole litters may be beneficial in improving post-weaning performance.

(Key words: creep feeding, feed management, lactation.)

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Introduction

Numerous studies have demonstrated a positive relationship between pre-weaning growth and post-weaning performance. Increased nutrient availability to suckling piglets is considered a major determinant of birth-to-weaning growth rate, which can be provided either by improving the sow's milk output using nutrient-dense lactation diets or providing highly digestible creep feed to piglets during the suckling period. The effect of lactation feed intake and creep feeding on pre- and post-weaning performance have been evaluated independently in previous studies; however, there has been no work done on the effect of these two nutritional regimens in a single study. In addition, creep feeding has been suggested to reduce the nutritional load in lactating sows especially with large litters, which may have positive benefits in reducing lactation weight loss and weaning-to-estrus interval. However, there has been no study at present to support this claim. Therefore, the objectives of this experiment were to evaluate the effect of lactation feed intake and creep feeding on pre- and post-weaning performance, and to determine the effect of creep feeding on body weight loss, back fat thickness, and weaning-to-estrus interval in sows.

Procedures

A total of 84 sows (PIC, Line 1050) and their litters were used in this study conducted at the Kansas State University Swine Research and Teaching Center farrowing facilities. Sows used in this experiment were from three batches of sows farrowed in August, October, and November 2006, with 28 experimental sows included from each batch. Sows were blocked according to parity and date of farrowing and were allotted to four experimental treatments using a randomized complete block design in a 2 × 2 factorial with lactation feed intake (*ad libitum* vs. restricted) and creep feeding (none vs. creep) as factors. Piglets were cross-fostered within each block to standardize litter weights and litter size (>11 pigs). The sow or litter was the experimental unit with 21 replicates per treatment.

A common lactation diet (1,586 kcal ME/lb, 0.97% TID Lys) was used in the study (Table 1). From d 3 of lactation, *ad libitum* sows were allowed free access to feed while restricted sows were fed 25% lower than those fed *ad libitum*. In the creep-fed treatments, a creep diet (1,585 kcal ME/lb, 1.56% TID Lys) with 1.0% chromium oxide was offered *ad libitum* at d 3 until weaning (d 21). The creep diet was in pellet form (2-mm pellets) and was fed using a rotary creep feeder with hopper (Rotecna® Mini Hopper Pan, Rotecna SA, Spain).

Piglets were weighed individually at d 3, 7, 14, and 21 (weaning). Amount of creep feed consumed was determined daily. Fecal samples from all creep-fed pigs were taken using sterile swabs once per sampling day on d 7, 14, and 21. The cotton-tipped swab was inserted into the anal opening in a clockwise motion for about 2 inches and pulled slowly for fecal collection. Fecal color was assessed to categorize piglets as eaters or non-eaters of creep feed. Piglets were categorized as eaters when the fecal sample was colored green at least once on any of the three sampling days. Non-eaters were creep-fed piglets that never showed green-colored feces. Pigs that were not provided with creep feed were designated as no creep pigs. At weaning, 624 out of 819 pigs were blocked according to initial weight and creep feeding (no vs. yes) and were used in three different nursery trials. Extra pigs (n=195) were also housed in the nursery facility and fed a common diet. Pigs and feeders were weighed weekly until d 28 post-weaning to calculate for average daily gain, average daily feed intake, and feed to gain ratio.

Weekly feed intake of the sows was recorded to calculate total and average daily feed intake. Sows were weighed and P2 backfat thickness (6.5 cm from the midline over the last rib) were measured post-farrowing and at weaning. Estrus detection using back pressure test were performed twice a day from weaning until 14 d after weaning to determine days to estrus and percentage of sows returning to estrus within 14 d. In this study, six sows were removed from the test due to either poor daily feed intake or death of the sow. General health of the piglets was checked daily and use of medication was monitored. Temperature in the farrowing facility was maintained at a minimum of 20°C, and supplementary heat was provided to the piglets using heat lamps when needed.

Periodic and cumulative average daily gain and creep feed intake were calculated for each treatment group. Pre-weaning mortality was also calculated. The coefficient of variation for pig weights within each litter was determined at d 3 and 21. Sow body weight loss, change in P2 back fat thickness, and weaning-to-estrus interval were calculated. Data were analyzed as a randomized complete block design using PROC MIXED of SAS. Regression models for daily litter creep feed intake were developed using PROC REG of SAS. Logistic regression curves were also developed using PROC LOGISTIC of SAS to determine estimated probabilities of changes in the proportion of eaters as determined by weights on d 0 (birth), d 3, and at weaning.

Results and Discussion

The effects of lactation feeding level and creep feeding on sow performance are shown in Tables 2 and 3. Sows had an average parity of 1.6 ± 0.7 and lactation length of 21.1 ± 1.9 d. There was no significant interaction between lactation feeding level and creep feeding on any of the performance parameters measured; therefore, only main effects will be discussed. *Ad libitum*-fed sows had 32 and 26% greater total (219.2 vs. 149.6 lb, *P*<0.0001) and daily (10.8 vs. 8.0 lb, *P*<0.0001) feed intake than restricted-fed sows, respectively. There were no differences in post-farrowing (*P*<0.37) and weaning (*P*<0.23) weights of *ad libitum* and restricted-fed sows. However, *ad libitum* feeding of sows reduced lactation weight loss (-33.0 vs. -52.9 lb; *P*<0.01) compared to limit-fed sows. Backfat thickness after farrowing (*P*<0.84) and at weaning (*P*<0.44) were also similar; likewise, backfat loss throughout lactation did not differ (*P*<0.27) between *ad libitum* and limit-fed sows. Days to estrus for sows that returned to estrus by d 14 after weaning were similar (*P*<0.83) between *ad libitum* and restricted-fed sows. However, *ad libitum* feeding increased (90 vs. 71%, *P*<0.03) the percentage of sows returning to estrus by d 14.

These results conform with similar studies investigating the effects of energy restriction during lactation or effects of high ambient temperature in lactating sows. Sows with restricted energy intakes lost more weight and backfat during lactation than sows allowed *ad libitum* intake. One response that was different from previous studies was that differences in backfat loss were not observed in this study. In previous studies, daily energy intake was restricted to a level (33 to 50%) greater than the feed restriction in this study (26% of *ad libitum* intake), which may help explain the differences in results. The higher rate of sows failing to exhibit estrus within 14 d demonstrates the detrimental effects of limit feeding in sows during lactation. Low feed intake during lactation has been previously shown to depress luteinizing hormone (LH) secretion, which is required for the release of eggs from follicles into the ovary and commence another reproductive stage.

Providing litters with creep feed did not affect total (*P*<0.56) and daily (*P*<0.57) feed intake of sows. Likewise, there were no differences in sow weights after farrowing (*P*<0.27) and at weaning (*P*<0.48), or in weight loss (*P*<0.75) between sows with litters provided with and without creep feed. The same effect was observed in backfat thickness after farrowing (*P*<0.14) and at weaning

(P<0.21), and in backfat loss (P<0.34). However, creep feeding increased days to estrus (5.4 vs. 4.9 d; P<0.03) for sows that returned to heat by 14 d. There were no differences (P<0.77) in the proportion of sows which returned to estrus within 14 d between sows with creep and non-creep fed litters. There has been no previous study evaluating the effects of creep feeding on sow performance, although claims have been made on some potential benefits of the practice. Creep feeding was thought to reduce the nutritional load in lactating sows especially with large litters, which may have corollary effects in reducing lactation weight loss and weaning-to-estrus interval. These were not observed in this study where creep feeding for 18 d did not have any effect on sow performance except for increasing days to estrus. The amount of litter creep feed intake observed in this study was too small (3.65 Mcal; 1.26% of total energy intake of the sows) to generate any appreciable, nutritional savings to lactating sows that may merit a reduction in mobilized body reserves or improve their metabolic state. The impact of creep feeding on reducing nutrition requirements of the sow may be greater with older weaning ages, but does not appear to be beneficial in a 21-d lactation period.

The effects of lactation feeding level and creep feeding on pig and litter performance are shown in Tables 4 and 5. Lactation feeding level had no effect on litter size at weaning (P<0.93) and pre-weaning mortality rate (P<0.76). *Ad libitum* feeding of sows improved total (P<0.04) and daily (P<0.04) gains of litters and tended to increase litter weaning weights (P<0.10) compared to limit-fed sows. Likewise, total gain (P<0.04), daily gain (P<0.03), and weaning weights (P<0.06) of individual pigs were higher in *ad libitum*-fed sows. These results conform with other studies, which demonstrate the benefits of high lactation feed intake on pre-weaning growth rate. The coefficient of variation (CV) in litters of sows fed *ad libitum* and restricted were similar at weaning (P<0.22); likewise, there were no differences (P<0.78) in litter CV change between the two levels of lactation feeding.

Creep feeding increased litter size at weaning by 0.4 pig per litter; however, this difference was not significant (P<0.19). The increase in litter size was mainly due to a reduction in pre-weaning mortality rate after cross-fostering (3.9 vs. 7.3%; P<0.06) with creep feeding. There were no differences in total gains (P<0.55), daily gains (P<0.53), and weaning weights (P<0.54) of pigs at weaning between creep and non-creep fed litters. Total (P<0.17) and daily (P<0.16) gains of litters were also unaffected by creep feeding; however, litter weaning weights tended to be greater (P<0.09) in creep-fed litters due to reduced mortality rates after cross-fostering and greater (P<0.04) litter weights at the start of creep feeding (d 3). There were no differences in litter CV at weaning (P<0.25) and CV change throughout lactation (P<0.49), which indicates the lack of effect of creep feeding in improving litter uniformity.

Litters of restricted-fed sows had 33% greater (0.12 vs. 0.09 lb; P<0.02) creep feed intake than litters of *ad libitum* fed sows from d 3 to 7 (Figure 1). However, no differences (P<0.41) in litter creep feed intake were observed in other periods. Overall, total creep feed intake was highly variable between litters, ranging from 0.58 to 5.18 lb/litter throughout the 18 d period that creep feed was provided. Total creep feed intake of litters did not differ (2.24 vs. 2.28 lb/litter; P<0.93) between *ad libitum* and restricted-fed sows, which suggests that a limited nutrient supply to both sows and litters did not drive piglets to consume more creep feed. About 72 and 77% of the total creep feed intake of litters of restricted and *ad libitum*-fed sows was consumed in the last week prior to weaning. The daily creep feed intake of litters increased quadratically (R^2=0.22; P<0.0001) from d 3 to weaning; however, intakes greater than 0.1 lb per litter were attained only from d 13 before weaning (Figure 2). About 59 and 41% of the creep-fed piglets were categorized as eaters and non-eaters (Figure 3). Of pigs identified as eaters, 23, 20, and 57% were positive for creep feed consumption on d 7, 14, and 21, respectively (Figure 4). The higher intake and percentage of eaters created in the last week prior to weaning indicate that piglets more readily accept and consume greater amounts of creep feed at an older age. Thus, creep feed consumption seems to be more related to the maturity of the piglets rather than the age of induction of creep feeding.

Logistic regression curves showed a positive relationship between birth weight (P<0.03) and a tendency for a positive relationship with d 3 weights (P<0.17) and the proportion of eaters and non-eaters among litters. There was no relationship (P<0.94) between d 21 and creep feed consumption category. The estimated probability of the changes in the proportion of non-eaters in creep-fed litters increased from 41 to 86% as pig birth weight increased from 1.2 to 5.6 lb (Figure 5). Based on the logistic model, birth weights of less than 2 lb have more than 50% probability of becoming eaters. This indicates that smaller pigs at birth have a higher probability of becoming eaters of creep feed while heavier pigs tend more to become non-eaters. This suggests differences in their consumption patterns and the value of creep feeding within whole litters. Larger pigs have greater ability to compete for prime suckling positions in the udder, and given the choice, seemed to prefer milk over the creep feed. Creep feed then provides an alternative nutritional source to smaller, less competitive piglets.

From d 0 to 28 post-weaning, there was no effect of creep feeding on d 28 weights (P<0.93), ADG (P<0.86), ADFI (P<0.93), and F/G (P<0.95) compared to non-creep fed pigs (Table 6). However, when pigs were categorized based on creep feed consumption category, eaters tended to be heavier until d 28 post-weaning (Figure 6; P<0.16) and had higher (P<0.06) ADG and total gains than non-eaters and no creep pigs (Figure 7). Eaters and non-eaters were mixed at weaning, which may explain the lack of differences between creep and non-creep fed pigs. The differences in post-weaning gain also agree with previous studies, where eaters, non-eaters, and non-creep fed pigs were compared. These studies have attributed these differences in post-weaning growth efficiency to shorter latency time (interval between weaning and first feed intake) and greater post-weaning feed intake in eaters. A recent study using segment perfusion tests also showed greater net absorption in the small intestine of eaters compared to non-eaters, though some studies have reported no effect of pre-weaning eating activity on gut morphology.

In conclusion, low feed intake during lactation negatively affected both sow and litter performance. Creep feeding tended to improve litter weaning weights due to higher survivability, but had no effects on pre-weaning gain and sow performance. When pigs were categorized based on creep feed consumption category, eaters had greater post-weaning gains and weights than non-eaters and non-creep fed pigs. Creating more eaters in whole litters may be beneficial in improving post-weaning performance. Thus, factors, whether dietary or non-dietary, which can enhance the proportion of eaters in litters, should be investigated.

Table 1. Diet Composition (as-fed basis)

Ingredient, %	Creep[a]	Lactation[b]
Corn	6.15	60.00
Soybean meal (46.5% CP)	2.32	31.20
Spray dried whey	25.00	-
Fine ground oat groats	30.00	-
Extruded soy protein concentrate	10.00	-
Spray-dried animal plasma	6.00	-
Select menhaden fish meal	6.00	-
Lactose	5.00	-
Choice white grease	5.00	5.00
Monocalcium P (21% P)	0.35	1.45
Chromium oxide	1.00	-
Antibiotic	1.00	
Limestone	0.45	1.20
Zinc oxide	0.38	-
Salt	0.30	0.50
L-Lysine HCl	0.15	-
DL-methionine	0.15	-
Trace mineral premix	0.15	0.15
Vitamin premix	0.25	0.25
Sow add pack	-	0.25
Acidifier	0.20	-
Flavor	0.10	-
Vitamin E, 20,000 IU	0.05	-
Total	100.00	100.00
Calculated analysis		
Crude protein, %	23.9	19.6
TID Lysine, %	1.56	0.97
ME, kcal/lb	1,585	1,589
Ca, %	0.79	0.87
Available P, %	0.56	0.38
TID Lysine:ME ratio, g/Mcal	4.47	2.77

[a]Diet fed in pellet form.
[b]Diet fed in meal form throughout lactation.

Table 2. Effects of Lactation Feeding Level and Creep Feeding on Sow Performance (Interactive Effects)[ab]

	Lactation Feeding Level × Creep Feeding					Probability, *P*<		
	Restricted		*Ad libitum*					
Item	No	Yes	No	Yes	SED	Lactation	Creep	Lactation × Creep
No. of sows	19	19	20	20	-	-	-	-
Lactation length, d	21.0	21.1	20.9	21.1	0.1	0.39	0.25	0.89
Average parity	1.5	1.6	1.5	1.6	0.1	0.56	0.21	0.95
Lactation feed intake, lb								
Total, d 0 - 21	151.1	148.1	221.3	217.1	6.5	<0.0001	0.56	0.86
ADFI	8.0	7.9	10.9	10.6	0.3	<0.0001	0.57	0.79
Sow weight, lb								
Post-farrowing	475.6	487.0	463.8	478.2	15.9	0.37	0.27	0.90
Weaning	422.4	428.3	433.8	443.1	147	0.23	0.48	0.87
Change	-53.9	-51.8	-30.8	-35.3	5.2	<0.0001	0.75	0.38
Backfat, mm								
Post-farrowing	17.8	15.8	17.1	16.2	1.4	0.84	0.14	0.56
Weaning	12.6	12.1	13.4	12.3	0.9	0.44	0.21	0.63
Change	-5.3	-3.7	-3.6	-3.9	0.9	0.27	0.34	0.17
Days to estrus[g]	4.7	5.7	5.1	5.2	0.3	0.83	0.03	0.15
Return to estrus, %[h,i]	73.7	68.4	90.0	90.0	-	0.03	0.77	-

[a]Three groups of sows (total = 78, PIC Line 1050) were blocked according to day of farrowing and parity and allotted to four treatments in a 2 x 2 factorial with lactation feeding level (Restricted vs. *Ad libitum*) and creep feeding (No vs. Yes) as factors.
[b]There was no significant interaction (*P*>0.10) between lactation feeding level and creep feeding on any parameter measured.
[c]Sows on the restricted feeding program were fed 25% lower than those fed *ad libitum*.
[d]Creep feed with 1.0% chromium oxide was offered ad libitum from d 3 to weaning (21 ± 0.1 d).
[e,f]Means in the same row with different superscript differ (*P*<0.05).
[g]For sows returning to estrus within 14 d post-weaning.
[h]Percentage of sows returning to estrus within 14 d post-weaning.
[i]Means evaluated using a chi-square test.

Table 3. Effects of Lactation Feeding Level and Creep Feeding on Sow Performance (Main Effects)[ab]

Item	Lactation Feeding[c]		Creep Feeding[d]			Probability, *P*<		
	Restricted	*Ad libitum*	No	Yes	SED	Lactation	Creep	Lactation × Creep
No. of sows	38	40	39	39	-	-	-	-
Lactation length, d	21.1	21.0	21.0	21.1	0.1	0.39	0.25	0.89
Average parity	1.6	1.5	1.5	1.6	0.1	0.56	0.21	0.95
Lactation feed intake, lb								
Total, d 0 - 21	149.6[e]	219.2[f]	185.9	182.9	5.2	<0.0001	0.56	0.86
ADFI	8.0[e]	10.8[f]	9.4	9.3	0.1	<0.0001	0.57	0.79
Sow weight, lb								
Post-farrowing	481.3	471.0	469.7	482.6	11.6	0.37	0.27	0.90
Weaning	425.4	438.5	428.1	435.7	10.7	0.23	0.48	0.87
Change	-52.9[e]	-33.0[f]	-42.4	-43.5	3.8	<0.0001	0.75	0.38
Backfat, mm								
Post-farrowing	16.8	16.6	17.5	16.0	1.0	0.84	0.14	0.56
Weaning	12.4	12.9	13.0	12.2	0.7	0.44	0.21	0.63
Change	-4.5	-3.8	-4.5	-3.8	0.7	0.27	0.34	0.17
Days to estrus[g]	5.2	5.1	4.9[e]	5.4[f]	0.2	0.83	0.03	0.15
Return to estrus, %[h,i]	71.0[e]	90.0[f]	82.1	79.5	-	0.03	0.77	-

[a]Three groups of sows (total = 78, PIC Line 1050) were blocked according to day of farrowing and parity and allotted to four treatments in a 2 x 2 factorial with lactation feeding level (Restricted vs. *Ad libitum*) and creep feeding (No vs. Yes) as factors.
[b]There was no significant interaction ($P>0.10$) between lactation feeding level and creep feeding on any parameter measured; means of main effects are reported.
[c]Sows on the restricted feeding program were fed 25% lower than those fed *ad libitum*.
[d]Creep feed with 1.0% chromium oxide was offered *ad libitum* from d 3 to weaning (21 ± 0.1 d).
[e,f]Means in the same row with different superscript differ ($P<0.05$).
[g]For sows returning to estrus within 14 d post-weaning.
[h]Percentage of sows returning to estrus within 14 d post-weaning.
[i]Means evaluated using a chi-square test.

Table 4. Effects of Lactation Feeding Level and Creep Feeding on Litter and Pig Performance (Interactive Effects)[ab]

Item	Lactation Feeding Level × Creep Feeding				SED	Probability, *P*<		
	Restricted		*Ad libitum*					
	No	Yes	No	Yes		Lactation	Creep	Lactation × Creep
No. of litters	19	19	20	20	-	-	-	-
Pigs/litter								
d 3 (start creep)	11.1	10.9	10.8	11.1	0.3	0.75	0.99	0.32
d 21	10.3	10.5	10.1	10.7	0.4	0.93	0.19	0.59
Mortality, %	7.5	4.3	7.1	3.6	2.5	0.76	0.06	0.92
Litter weight, lb								
d 3 (start creep)	38.2	40.3	36.5	40.2	1.9	0.53	0.04	0.56
d 21	123.9	126.2	126.0	139.2	6.3	0.10	0.09	0.23
Litter BW gain, lb								
Total	94.6	94.8	97.6	108.2	5.4	0.04	0.17	0.19
ADG	5.20	5.20	5.34	5.94	0.29	0.04	0.16	0.17
Pig weight, lb								
d 3 (start creep)	3.8	3.8	3.7	3.8	0.1	0.66	0.45	0.88
d 21	12.1	12.0	12.5	13.1	0.4	0.06	0.54	0.30
Pig BW gain, lb								
Total	9.2	9.0	9.6	10.2	0.5	0.04	0.55	0.25
ADG	0.52	0.51	0.54	0.58	0.03	0.03	0.53	0.22
Litter CV, %[g]								
d 3 (start creep)	20.4	20.4	19.5	16.9	1.6	0.05	0.25	0.24
d 21	19.4	19.2	17.7	17.3	2.1	0.22	0.84	0.97
Change	-1.0	-1.2	-1.8	0.4	2.1	0.78	0.49	0.39

[a]Three groups of sows (total = 78, PIC Line 1050) were blocked according to day of farrowing and parity and allotted to four treatments in a 2 x 2 factorial with lactation feeding level (Restricted vs. *Ad libitum*) and creep feeding (No vs. Yes) as factors.
[b]There was no significant interaction (*P*>0.10) between lactation feeding level and creep feeding on any parameter measured.
[c]Sows on the restricted feeding program were fed 25% lower than those fed *ad libitum*.
[d]Creep feed with 1.0% chromium oxide was offered *ad libitum* from d 3 to weaning (21 ± 0.1 d).
[e,f]Means in the same row with different superscript differ (*P*<0.05).
[g]CV = coefficient of variation; values were determined from piglet weights within a litter.

Table 5. Effects of Lactation Feeding Level and Creep feeding on Litter and Pig Performance (Main Effects)[ab]

	Lactation Feeding[c]		Creep Feeding[d]			Probability, *P*<		
Item	Restricted	*Ad libitum*	No	Yes	SED	Lactation	Creep	Lactation × Creep
No. of litters	38	40	39	39	-	-	-	-
Pigs/litter								
d 3 (start creep)	11.0	10.9	11.0	11.0	0.3	0.75	0.99	0.32
d 21	10.4	10.4	10.2	10.6	0.3	0.93	0.19	0.59
Mortality, %	5.9	5.3	7.3[e]	3.9[f]	1.8	0.76	0.06	0.92
Litter weight, lb								
d 3 (start creep)	39.3	38.6	37.4[e]	40.3[f]	1.4	0.53	0.04	0.56
d 21	125.1[e]	132.6[f]	124.9[e]	132.7[f]	4.5	0.10	0.09	0.23
Litter BW gain, lb								
Total	94.7[e]	102.9[f]	96.1	101.5	3.9	0.04	0.17	0.19
ADG	5.20[e]	5.64[f]	5.27	5.57	0.21	0.04	0.16	0.17
Pig weight, lb								
d 3 (start creep)	3.8	3.8	3.7	3.8	0.1	0.66	0.45	0.88
d 21	12.0[e]	12.8[f]	12.3	12.5	0.4	0.06	0.54	0.30
Pig BW gain, lb								
Total	9.1[e]	9.9[f]	9.4	9.6	0.4	0.04	0.55	0.25
ADG	0.52[e]	0.56[f]	0.53	0.55	0.02	0.03	0.53	0.22
Litter CV, %[g]								
d 3 (start creep)	20.4[e]	18.2[f]	20.0	18.7	1.1	0.05	0.25	0.24
d 21	19.3	17.5	18.6	18.3	1.5	0.22	0.84	0.97
Change	1.1	0.7	1.4	0.4	1.5	0.78	0.49	0.39

[a]Three groups of sows (total = 78, PIC Line 1050) were blocked according to day of farrowing and parity and allotted to four treatments in a 2 x 2 factorial with lactation feeding level (Restricted vs. *Ad libitum*) and creep feeding (No vs. Yes) as factors.
[b]There was no significant interaction (P>0.10) between lactation feeding level and creep feeding on any parameter measured; means of main effects are reported.
[c]Sows on the restricted feeding program were fed 25% lower than those fed *ad libitum*.
[d]Creep feed with 1.0% chromium oxide was offered *ad libitum* from d 3 to weaning (21 ± 0.1 d).
[e,f]Means in the same row with different superscript differ (P<0.05).
[g]CV = coefficient of variation; values were determined from piglet weights within a litter.

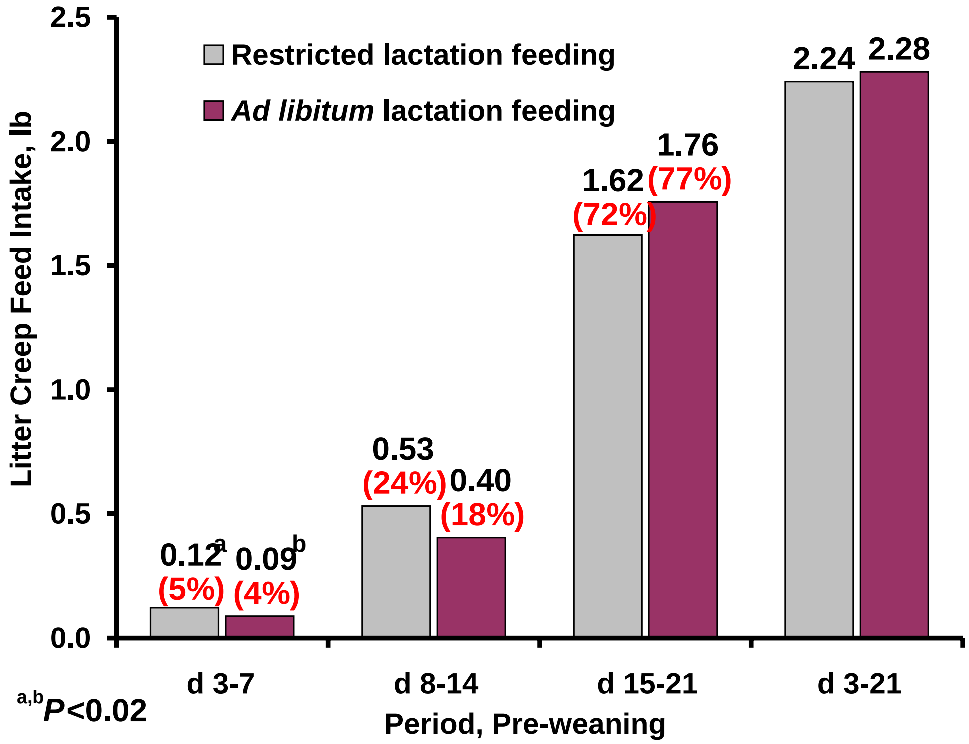

Figure 1. Effects of Lactation Feeding Level on Litter Creep Feed Intake (% of total litter creep feed intake in parentheses).

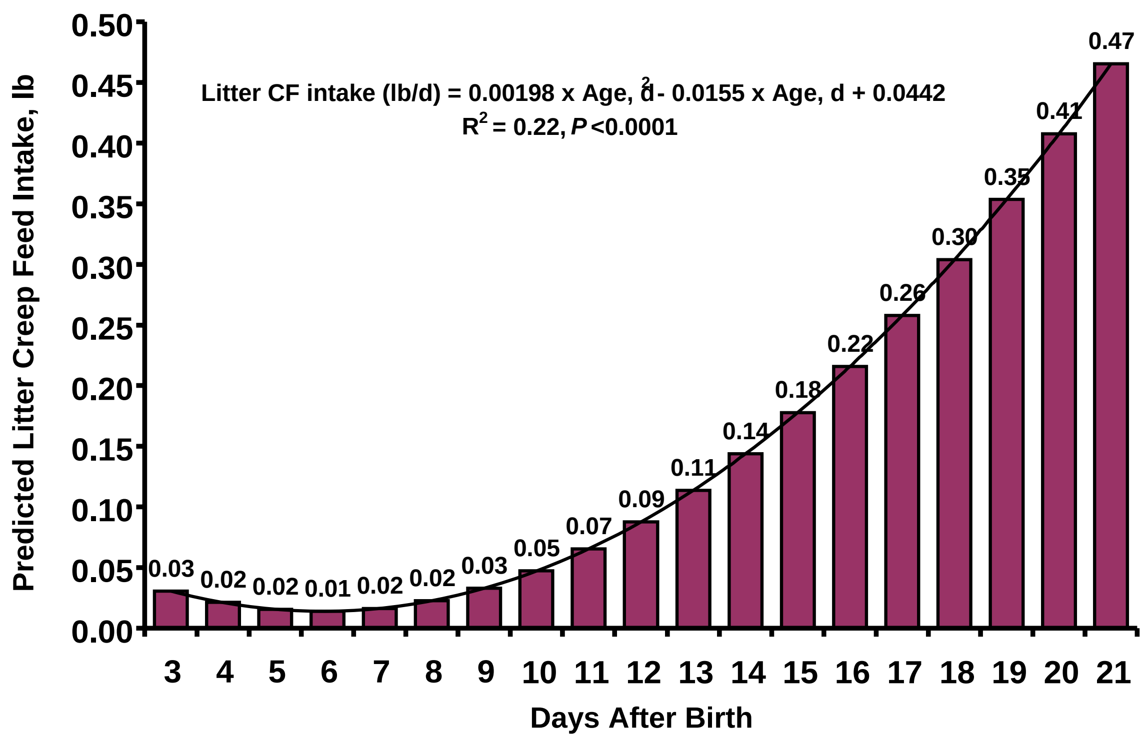

Figure 2. Predicted Daily Litter Creep Feed Intake (from 39 litters).

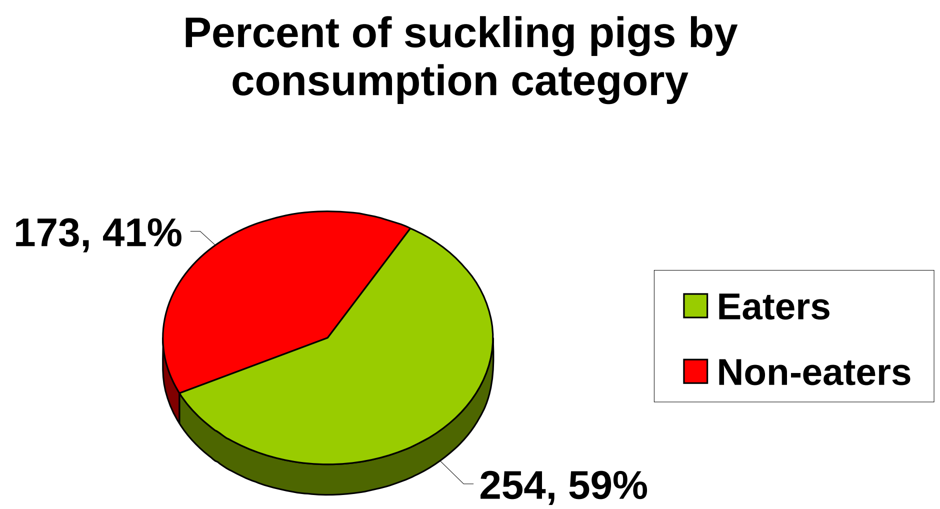

Figure 3. Characterization of Piglets Provided with Creep Feed Based on Consumption Category.

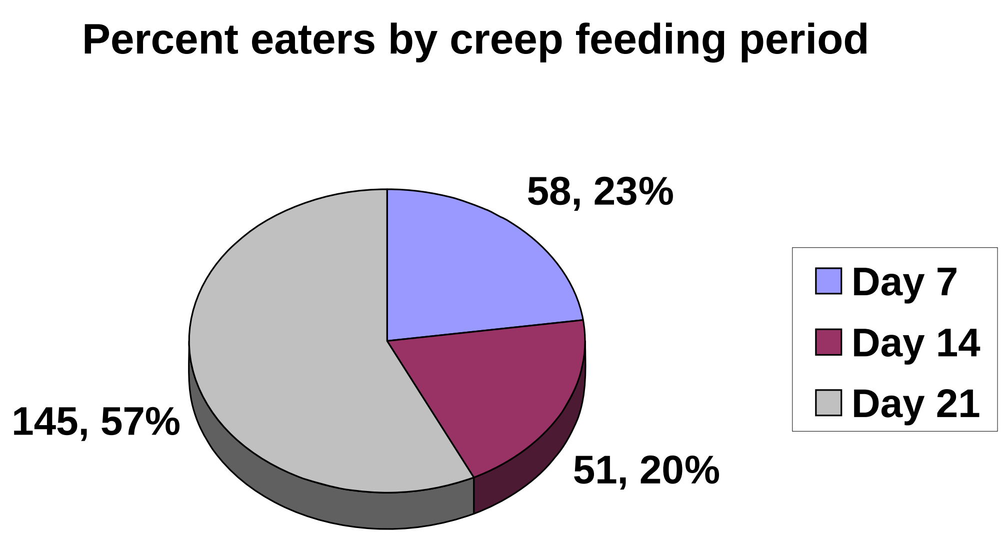

Figure 4. Frequency and Percentage of Pigs Identified as Eaters on D 7, 14, and 21.

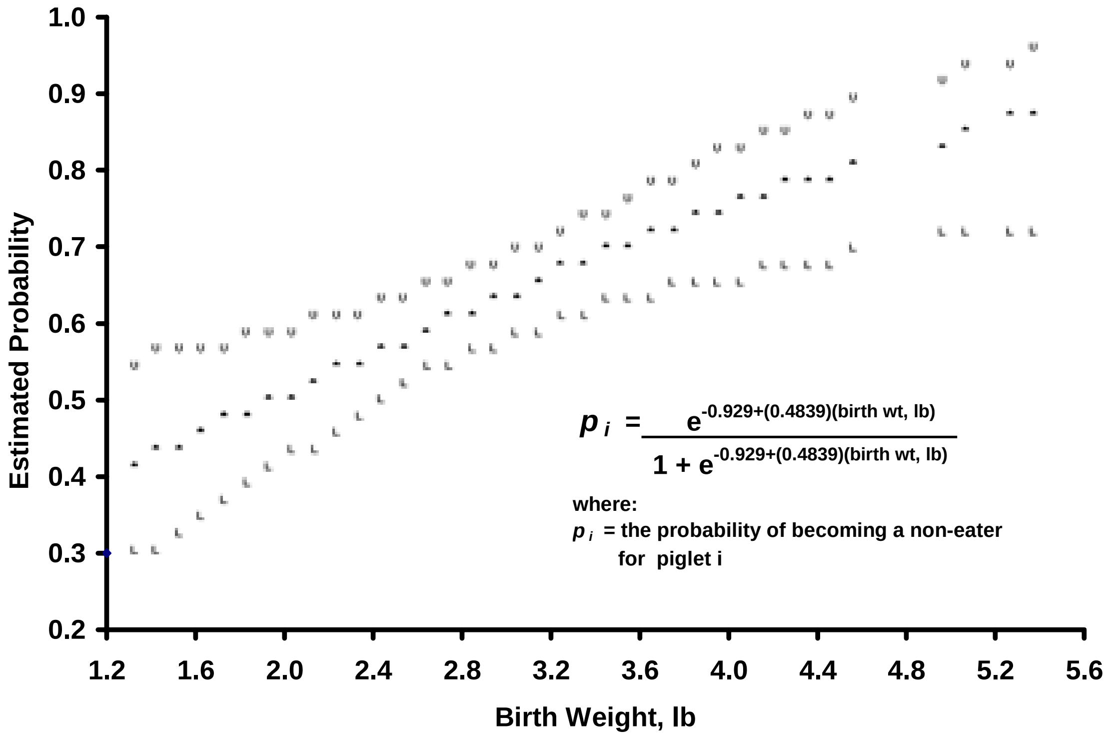

Figure 5. Logistic Curve of Changes in Proportion of Non-eaters as Affected by Changes in Birth Weight (U=Upper Limit, L=Lower Limit)

Table 5. Effects of Creep Feeding on Post-weaning Growth Performance[a]

Item	Creep Feeding		SED	Probability, *P*<
	No	Yes		
No. of pens	52	52	-	-
Pig weights, lb				
D 0	13.56	13.23	0.92	0.71
D 14	20.57	20.62	1.22	0.97
D 21	28.33	28.57	1.51	0.87
D 28	38.82	38.64	1.98	0.93
D 0 to 14				
ADG, lb	0.50	0.53	0.03	0.25
ADFI, lb	0.56	0.61	0.03	0.15
F/G	1.14	1.18	0.04	0.31
D 0 to 21				
ADG, lb	1.37	1.36	0.04	0.79
ADFI, lb	1.73	1.71	0.08	0.82
F/G	1.26	1.26	0.05	0.92
D 0 to 28				
ADG, lb	0.98	0.99	0.04	0.86
ADFI, lb	1.22	1.22	0.08	0.93
F/G	1.24	1.23	0.04	0.95

[a]A total of 624 out of 819 pigs (PIC L337 x C22) were blocked according to initial weight and creep feeding (no vs. yes); values are means of 52 pens of 6 pigs each, respectively

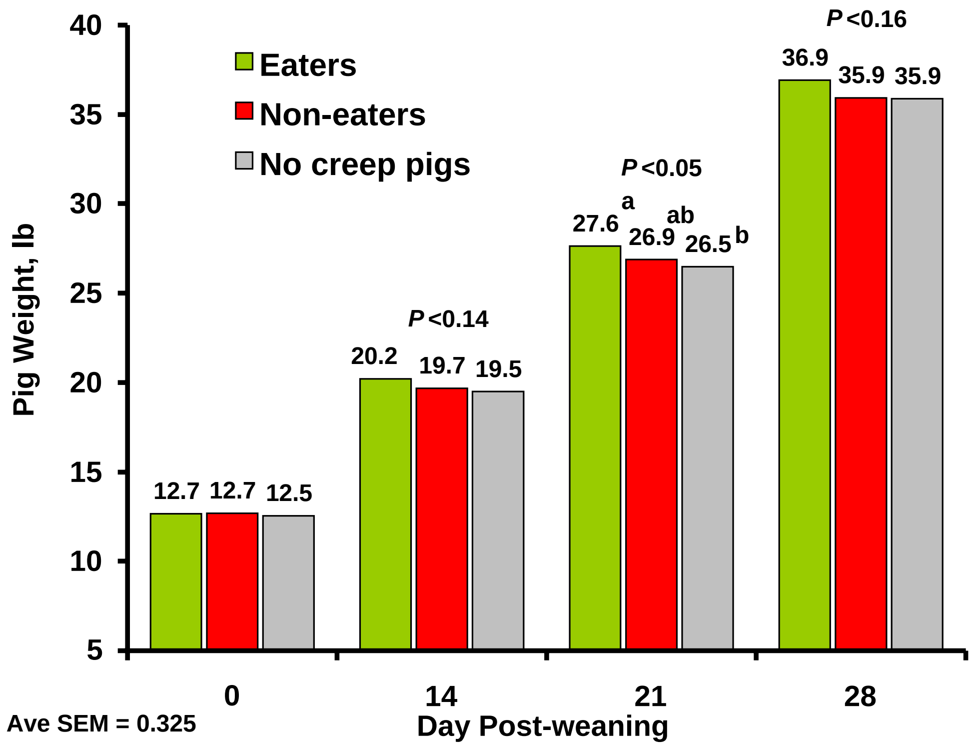

Figure 6. Post-weaning Live Weight Trends of Piglets According to Creep Feed Consumption Category (n = 819).

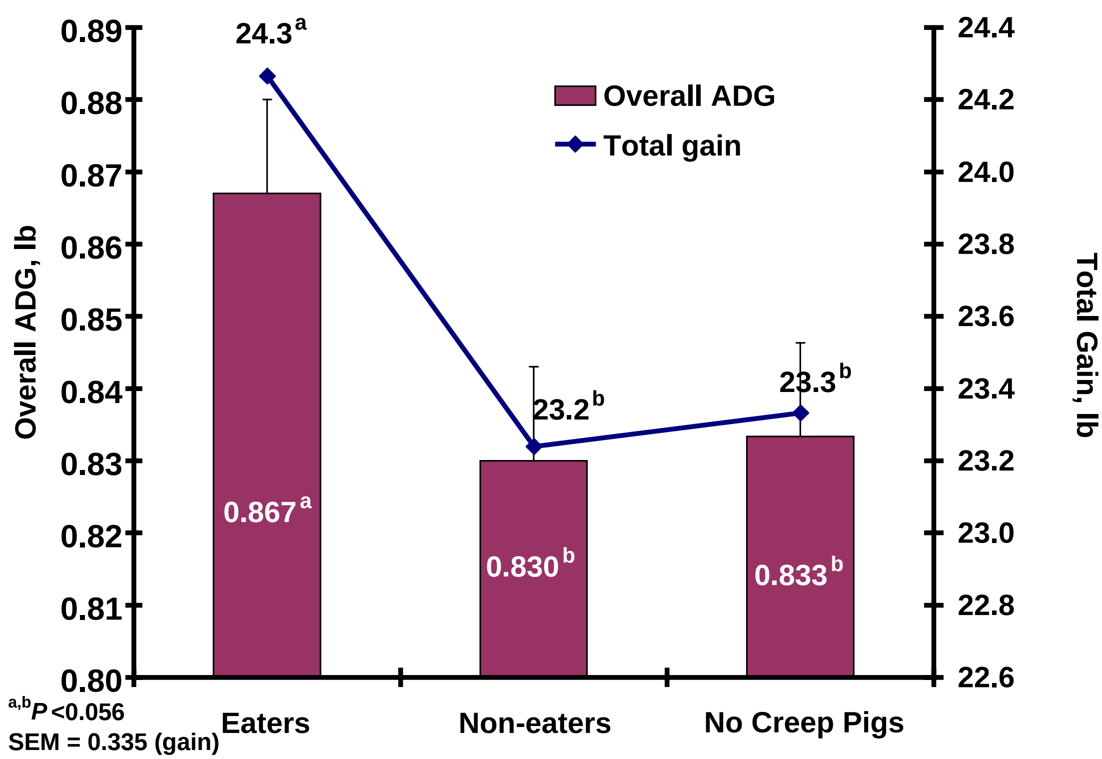

Figure 7. Overall Post-weaning ADG and Total Gain (d 0 – 28) of Piglets According to Creep Feed Consumption Category (n = 819).