LACTATION

CHARACTERIZING SOW FEED INTAKE DURING LACTATION TO EXPLAIN LITTER AND SUBSEQUENT FARROWING PERFORMANCE

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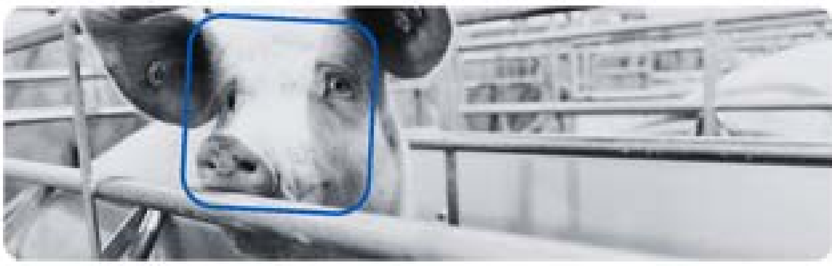
SUMMARY

This study investigated different sow feed intake patterns during lactation and average daily feed intakes within parity on current and subsequent farrowing and litter performance. Findings revealed sows that have consistently low intake throughout the lactation period have a significant reduction in average pig wean weight, a greater percentage of pre-wean mortality, and take a day or longer to return to estrus compared with sows that have average or above feed intake throughout the lactation period. Specifically, older parity sows were heavier, had greater feed intake, nursed heavier litters, and had litters with less pre-weaned mortality compared with younger parity sows. The average pig weaned weight and subsequent total pigs born improved as intake increased within parity. Pre-wean mortality decreased as feed intake increased within parity. These findings highlight the importance of ensuring sows are not only eating enough but that they are consuming more than average when possible, to continually improve current and subsequent farrowing and litter performance. This study provides important information that nutritionists can use to reformulate diets to better target sows that are not consuming adequate nutrients during lactation to help reduce negative impacts on sow and litter performance.

KEY TAKEAWAYS

1. Tracking individual feed intake patterns are vital in allowing producers to focus on under-consuming sows that may be lysine and energy deficient.
2. Lactational lysine requirements depend on litter size and piglet growth rates; and when those requirements are not met negative impacts can be noticed on both the sow and her litter.
3. Within parity, as feed intake increases, pre-weaning mortality decreases; emphasizing the importance of limiting under-consuming sows within the herd.
4. Sows with subpar feed intake are less likely to have full-value piglets in their current and subsequent litters.
5. Having a proper understanding of which sows fall into which feed consumption categories may allow producers to monitor sows that need help improving daily feed intake to prevent lysine and energy deficiencies.



ABSTRACT

Variation in sow feed intake results in nearly 20% of sows consuming less than the recommended lysine intake for lactating sows. The lysine requirement for lactating sows is based on required milk production. Milk production needs are based on litter size and piglet average daily gain (ADG). Because litter size has increased year over year, lysine requirements have likely increased, but dietary inclusion levels have not necessarily been adjusted. This leads to inadequate daily lysine intake and may negatively impact sow body condition and litter performance. The objective was to characterize average daily feed intake of sows and define feed intake patterns and their effects on sow body weight, farrowing performance, litter performance, and subsequent farrowing performance. Average daily feed intake during lactation was recorded for 4,248 sows from seven independent research studies. Data collection occurred from November 2021 through November 2023 at a commercial breed-to-wean facility in western Illinois. Each sow was categorized into six different intake patterns, including consistently low intake (LLL), low initial intake with gradual increase (LHH), and rapid intake increase (Rapid). Sows were also separated by intake level within parity. Sows in the LLL category were younger in parity, had the greatest pre-weaned mortality, weaned the lightest average pigs, and experienced the greatest loss in body weight percentage compared with sows in all other feed intake categories. Further, sows in the LLL and LHH categories had 1 fewer subsequent pig born compared with sows in the other 4 categories. These data support historical findings that feed intake patterns directly contribute to current litter farrowing performance. Lactation intake patterns also influence subsequent farrowing performance. Identifying under-consuming sows which are likely lysine deficient will allow nutritionists to formulate diets that cater specifically to these groups and may mitigate negative impacts on sow and litter performance.

INTRODUCTION

Approximately 20% of sows are not meeting their recommended lysine (Lys) requirement because of feed intake variation during lactation. There are approximately 6.2 million sows in the U.S. (USDA-NASS, 2023), meaning potentially 1.2 million lactating sows are consuming less than NRC recommendations for daily Lys intake. Current diets are formulated based on sow weight, milk yield, and body composition (NRC 2012). Diets are formulated on herd averages even though energy and nutrient requirements differ for every sow. Most first and second parity sows consume less feed than the herd average (Gourdine et al., 2004; Strathe et al. 2017; Piñeiro et al., 2019) and therefore do not eat enough feed to meet their daily Lys requirement. Further, sow mortality has nearly doubled in the last 10 years (Kikuti et al., 2023), resulting in first and second parity sows representing close to half the herd population making the average parity of sow herds in the U.S today less than 3.5. Consuming adequate Lys is essential in maximizing a sow's productivity and minimizing loss of sow body condition (Touchette et al., 1998; Hojgaard et al., 2019).

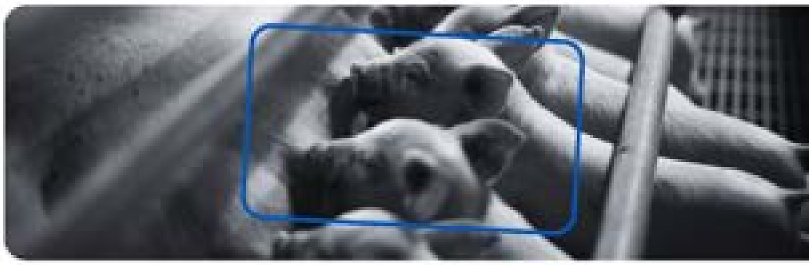
Inadequate daily feed intakes during lactation have long been associated with a reduction of sow body condition and reproductive failure (Koketsu et al., 1996b), negative impacts on litter performance such as pre-weaning mortality rate (PWM) and pig weaning weights (Koketsu et al., 1996b,1997; Prunier et al. 1997; Sulabo et al. 2010), as well as subsequent farrowing performance (Koketsu et al., 1996b,1997; Kruse et al., 2011). Conversely, achieving high feed intake during lactation can improve pig wean weights and sow body condition (Eissen et al., 2003; Strathe et al., 2017), and shorten wean to estrus interval (Strathe et al., 2017), which is important for sow retention in the breeding herd.

In addition to variation in average daily feed intake (ADFI), sows differ in their daily intake patterns (Koketsu et al., 1996a,1997). Even so, these intake patterns were characterized almost 30 years ago and may not represent current production practices, feed ingredients, or genetics of sows raised on a commercial farm. Further, these historical characterizations did not include subsequent farrowing performance and therefore omitted contributions to sow retention. Identifying feed intake patterns is crucial for providing nutritionists the opportunity to formulate diets that meet a greater percentage of total sows' nutritional needs. Therefore, the objective was to summarize the effects of average daily feed intake, and feed intake patterns on parity, sow body weight, farrowing performance, litter performance, and subsequent farrowing performance of sows on a commercial farm in western Illinois. It was expected that sows with adequate, consistent feed intake during lactation would exhibit positive impacts to farrowing, litter performance, and subsequent performance.

MATERIALS AND METHODS

DATA COMPILATION

Data aggregated from seven independent studies were collected on a total of 4,248 multiparous females (PIC 1050; PIC, Hendersonville, TN). There were 1,023 gilts, 868 first parity sows, 600 second parity, 1,657 parity 3 through 6, and 100 parity 7 and older sows included in the data set. Data collection occurred on a commercial breed-to-wean farm in western Illinois between November 2021 and November 2023.

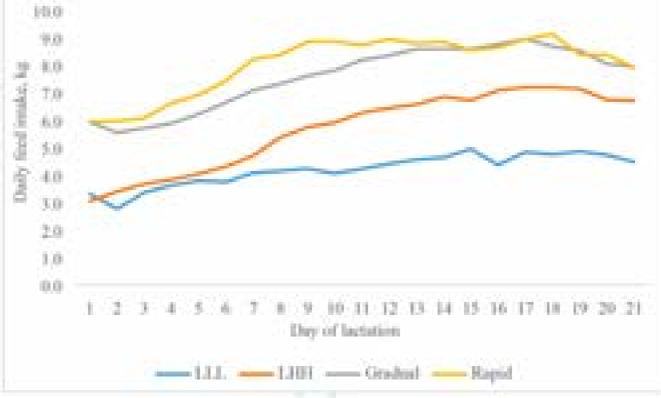


FEEDING

Sows were loaded into farrowing rooms on day 112 of gestation. Before farrowing, sows were fed 1.13 kg of feed in the morning and 1.13 kg of feed in the afternoon for a total of 2.26 kg of feed per day.

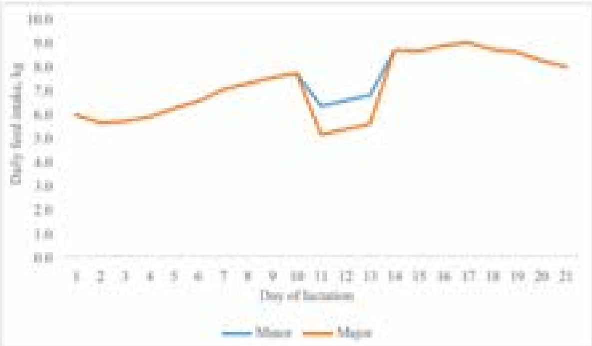
On the day of farrowing, sows were provided ad libitum access to feed until the piglets were weaned and the sows were removed from the farrowing house after approximately 21 days of lactation. Feed was measured each time it was delivered to sows to measure total lactation feed intake. Lactation length was recorded to calculate ADFI. Feed refusals were weighed and removed from total lactation intake. Sows were categorized into one of six feed intake patterns using modified historical categories used to describe feed intake during lactation (Koketsu et al., 1996a). The patterns were defined as: consistently low intake (<5.5 kg/d) throughout the lactation (LLL); low intakes (<5 kg/d) in the first week, then gradually increased throughout the rest of the lactation period (LHH); gradual increase in intake throughout lactation with no decrease and a peak intake after day 10 of lactation (Gradual); rapid increase in intake with no decrease and the peak intake met before day 10 (Rapid, Fig. 1).

FIGURE 1



A major decrease in feed intake (>1.6 kg decrease for ≥ 2 d) any time during lactation (MAJOR); minor decrease (≤ 1.6 kg for ≥ 2 day) (MINOR, Fig. 2). Sows were also separated into low (quartile 1; ≤ 25%), average (quartile 2-3), or high feed intake (quartile 4; ≥75%) by parity (P1, P2, P3+) categories.

FIGURE 2



SOW, LITTER, AND SUBSEQUENT PERFORMANCE

Body weights were recorded for every sow as they entered the farrowing room on day 112 of gestation, and again at weaning using a calibrated individual scale (Digistar- SW300, Digi-Star LLC, Fort Atkinson, WI). Farrowing performance (total pigs born, pigs born alive, total stillbirths, and mummies) was recorded for every sow. Cumulative litter birth and weaning weights were either calculated from summing individual weights of the piglets using a tared empty tub on a scale (UWE electronic scale, model AMP-150) or weighing the entire litter at one time (UWE electronic scale, model AMP-150). Pigs were cross-fostered as necessary within 24 hours of farrowing.

Starting litter weight was calculated by subtracting the cross-fostered pig's birth weight from the source litter and adding that weight to the destination litter as well as removing the weights of pig mortalities before cross-fostering occurred.

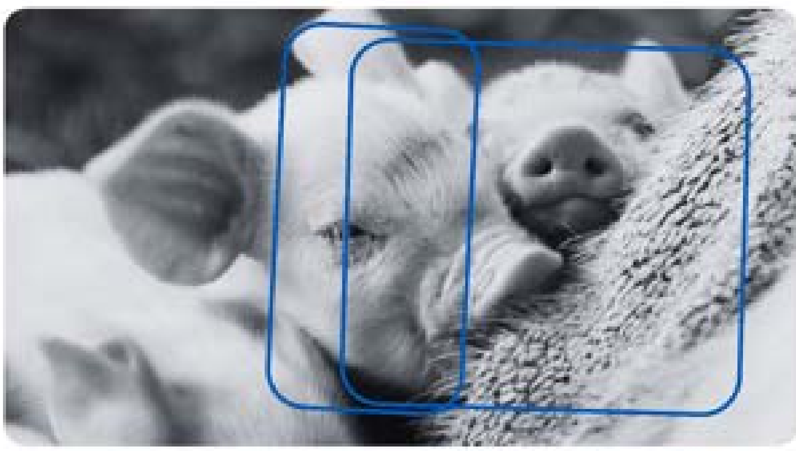
Pig mortalities were weighed and recorded to calculate pre-weaning mortality rate. Pigs were weighed and counted again at weaning. Subsequent farrowing performance including wean to estrus interval (WEI), total piglets born, piglets born alive, still births, and mummies was sourced from Porcitec Ultimate 2021.

STATISTICAL ANALYSIS

Feed intake pattern data were analyzed as a one-way ANOVA using the MIXED procedure in SAS (SAS Inst. In., Cary, NC). Sow (N = 4,248) was used as the experimental unit with fixed effect of feed intake pattern. Least squares means were separated using the probability of differences (PDIFF) option. Trial of origin was considered a random variable and used as blocking criteria to account for variability due to research conditions.

Sow parity, feed intake category, and the interaction between parity and feed intake category data were analyzed as a 3 × 3 factorial arrangement of treatments in a Randomized Complete Block Design. Least squares means were separated using the probability of differences (PDIFF) option. Trial of origin was considered a random variable and used as blocking criteria to account for variability due to research conditions. Means were considered significantly different at $P \leq 0.05$.

Pearson correlation coefficients were calculated between daily feed intake during lactation and other traits of interest using the CORR procedure of SAS (SAS Inst. In., Cary, NC).



RESULTS

CORRELATIONS BETWEEN LACTATION FEED INTAKE AND OTHER PERFORMANCE TRAITS

Sow feed intake during lactation was correlated with numerous other production traits (Table 1). Feed intake was positively correlated with parity (r = 0.46, P < 0.0001), pig weaning weight (r = 0.37, P < 0.0001), sow body weight change during lactation (r = 0.34, P < 0.0001), subsequent total piglets born (r = 0.14, P < 0.01), subsequent pigs born alive (r = 0.07, P < 0.0001), and subsequent mummies (r = 0.06, P < 0.01). Sow feed intake during lactation was inversely correlated with pre-weaned mortality (r = -0.07, P < 0.0001), and wean-to-estrus interval (r = -0.04, P = 0.01).

Table 1. Pearson correlation coefficients (r) between sow daily feed intake during lactation and other production traits

Item	Correlation coefficient	*P*- value
Parity	0.46	<0.0001
Average piglet weaning wt	0.37	<0.0001
Pre-wean mortality	-0.07	<0.0001
Sow body weight change	0.34	<.0001
Wean-to-estrus-interval	-0.04	0.01
Subsequent total piglets born	0.14	<0.0001
Subsequent piglets born alive	0.07	<0.01
Subsequent still births	0.15	<0.0001
Subsequent mummies	0.06	<0.01

FEED INTAKE PATTERN ON SOW AND LITTER PERFORMANCE

A total of 4,248 sows were categorized into six different feed intake patterns: 86 LLL (2.02%), 565 LHH (13.30%), 1,250 Major (29.43%), 503 Minor (11.84%), 465 Rapid (10.95%), 1,379 Gradual (32.46%, Table 2).

Sows characterized as LLL (0.44) had the lowest parity compared with all other categories (P ≤ 0.01) and Rapid (2.98) had the greatest parity compared to all categories (P < 0.01). Parity for LHH (1.08) was less than all categories (P < 0.001) except LLL (P = 0.01). Parity did not differ among Major, Minor, and Gradual categories (P ≥ 0.20, Table 2).

Table 2. Average daily feed intake patterns effects on lactation performance

	Treatment[1]							
Item	LLL	LHH	Major	Minor	Rapid	Gradual	SEM	*P*-value
Sows, n	86	565	1250	503	465	1379		
Sows in each category, %	2.02	13.30	29.43	11.84	10.95	32.46		
Parity	0.44^{a}	1.08^{b}	2.63^{c}	2.49^{c}	2.98^{d}	2.57^{c}	0.24	<0.01
Lactation length, d	20.35^{a}	21.78^{cd}	21.6^{bc}	21.98^{d}	20.75^{a}	21.46^{b}	0.79	<0.01
Avg. daily intake, kg/d	4.50^{a}	5.75^{b}	7.38^{c}	7.48^{cd}	7.90^{e}	7.46^{d}	0.21	<0.01
SID[2] Lysine intake, g/d	42.99^{a}	55.86^{b}	71.44^{c}	72.13^{cd}	76.61^{e}	72.31^{d}	3.25	<0.01
Energy intake Mcal/d	14.50^{a}	18.58^{b}	23.79^{c}	24.12^{cd}	25.50^{e}	24.08^{d}	0.66	<0.01
Avg. wean wt, kg/pig	4.82^{a}	5.50^{b}	5.87^{c}	6.05^{d}	5.93^{cd}	6.00^{d}	0.22	<0.01
Pre-wean mortality, %	21.61^{c}	14.96^{b}	14.78^{b}	14.26^{ab}	14.71^{ab}	13.74^{a}	1.70	<0.01
[3]Sow body weight after farrowing, kg	181.02^{a}	191.04^{b}	217.34^{c}	214.10^{c}	223.12^{d}	215.11^{c}	4.29	<0.01
Sow body weight change, %	-5.07^{a}	-2.70^{b}	0.09^{c}	0.41^{cd}	1.10^{d}	0.35^{c}	1.27	<0.01
Wean-to-estrus interval, d	6.91^{c}	5.82^{bc}	5.10^{a}	5.37^{ab}	5.19^{ab}	5.45^{ab}	0.60	0.01

$^{a-e}$Treatments within a row that do not share a superscript differ (*P* < 0.05)

[1]Consistently low intake (<5.5 kg/d) throughout the lactation (LLL); low intakes (<5 kg/d) in the first week, then gradually increased throughout the rest of the lactation period (LHH); gradual increase in intake throughout lactation with no drop and a peak intake after d 10 of lactation (Gradual); rapid increase in intake with no drop and the peak intake met before d 10 (Rapid); a major drop in feed intake (> 1.6 kg decrease for ≥ 2 d) any time during lactation (MAJOR); minor drop (≤ 1.6 kg for ≥ 2 day) (MINOR). These categories were adapted from those originally described by Koketsu et al., 1997 (doi:10.1016/S0301-6226[97]00050-X).

[2]SID - Standardized ileal digestible

[3]Sow body weight after farrowing = pre-farrow adjusted weight - conceptus weight. Pre-farrow adjusted weight = total piglets born × 0.085 × days until farrowing from time of weighing + pre-farrow weight. Conceptus weight = 0.3 + 1.329 × total piglets born × average piglet birth weight.

Lactation length was the shortest in LLL (20.35 d) and Rapid (20.75 d) compared to all categories (P < 0.001). Gradual (21.46 d) was greater than LLL and Rapid (P < 0.001) but not different from Major (P = 0.13). Major and LHH were not different (P = 0.13). Minor had the longest lactation length at 21.98 d compared with all other categories (P < 0.001) apart from LHH (P = 0.16). Daily feed intake was greatest in Rapid sows (7.90 kg/d) compared to all other intake patterns (P < 0.001, Table 2, Fig. 1).

Daily feed intake was the least in LLL (4.5 kg/d) compared to all other intake patterns (P < 0.001). LHH sows consumed 1.25 kg more feed per day compared to LLL sows but still at least 1.63 kg less than sows in all other categories (P < 0.001). Major ADFI was greater compared to LLL and LHH (P < 0.001), but 0.08 kg/d less compared to Rapid and 0.52 kg/d Gradual (P < 0.001) and not different from Minor (P = 0.10). Minor and Gradual ADFI did not differ (P = 0.87). SID Lysine intake per day was significantly different among all categories (P ≤ 0.04). LLL was (42.99 g/d) the lowest and Rapid (76.61 g/d) the highest. Metabolizable energy intake per day was not different between Minor (24.12 Mcal/d) and Gradual (24.08 Mcal/d; P = 0.84), and Minor and Major did not differ (P = 0.08). However, all other categories were significantly greater (P < 0.001). LLL (14.50 Mcal/d) consumed the least metabolizable energy each day and Rapid (25.50 Mcal/d) consumed the most metabolizable energy each day.

Average weaning weights of piglets from Minor (6.05 kg), Gradual (6.00 kg), and Rapid (5.93 kg) sows did not differ (P ≥ 0.11; Table 2) among those three categories but were at least 0.06 kg/pig heavier than sows categorized at LLL and LHH (P < 0.001).

Rapid was not different from Major (P = 0.34) and LLL sows weaned piglets that were at least 0.68 kg/pig lighter than all other categories (P < 0.001). Pigs from LHH sows weaned heavier than LLL (P < 0.001) pigs but were 0.37 kg/pig lighter than all other categories (P < 0.001).

Pre-weaned mortality was greatest in LLL (21.61%) compared to all other categories (P < 0.001).
Gradual (13.74%) had the lowest PWM but was not different compared to Minor (14.26%), or Rapid (14.71%, P ≥ 0.14) Rapid, Minor, Major, and LHH did not differ (P ≥ 0.36).

Sows categorized as LLL had the greatest percentage change in body weight during lactation (-5.07%) compared to all other categories (P < 0.001). Percentage change in body weight during lactation for sows categorized as LHH (-2.7%) was less than sows categorized as LLL (P < 0.001). Major (0.09%), Minor (0.41%), and Gradual were not different (0.35%; P ≥ 0.33), additionally, body composition change for Minor (0.41%) and Rapid (1.1%) sows did not differ (P = 0.12).

Wean-to-estrus interval was more than 1 day longer in LLL sows (6.91 d) compared to all other categories (P ≤ 0.01, Table 2) but did not differ compared to LHH (5.82 d, P = 0.07). Major had the shortest WEI at 5.10 d but was not different compared to Minor (5.37 d), Rapid (5.19 d), and Gradual (5.45, P ≥ 0.09). Minor, Rapid, and Gradual wean to estrus interval did not differ with LHH (P ≥ 0.06).

FEED INTAKE PATTERN ON SUBSEQUENT FARROWING PERFORMANCE

Subsequent farrowing performance was influenced by current lactation intake pattern (Table 3). Subsequent total born was at least 0.87 piglets less in LHH sows compared with sows categorized as Major, Minor, or Rapid. Subsequent total born was also greater in Minor (16.33 pigs) compared to LLL (15.17 pigs) and LHH (15.16 pigs; P ≥ 0.05) but not different compared to Major (16.03 pigs), Rapid (16.10 pigs), or Gradual (16.21 pigs; P ≥ 0.32). Subsequent still births were 0.08 fewer in LLL (0.20) and LHH (0.33) compared with all other treatment groups (P < 0.01). Because of the increase in subsequent total born and subsequent still births of the higher consuming treatment groups, there were no differences in subsequent piglets born alive (P = 0.71).

Table 3. Average daily feed intake patterns effects on subsequent farrowing performance

	Treatment[1]							
Item	LLL	LHH	Major	Minor	Rapid	Gradual	SEM	*P*-value
Subsequent total piglets born	15.17^{ab}	15.16^{a}	16.03^{bc}	16.33^{c}	16.10^{bc}	16.21^{bc}	0.53	<0.01
Subsequent piglets born alive	14.20	13.93	14.12	14.21	14.08	14.35	0.49	0.71
Subsequent still births	0.82^{a}	1.02^{a}	1.57^{bc}	1.77^{c}	1.71^{bc}	1.49^{b}	0.25	<0.01
Subsequent mummies	0.20	0.23	0.33	0.33	0.31	0.35	0.09	0.09

a-c Treatments within a row that do not share a superscript differ ($P < 0.05$)
[1] consistently low intake (<5.5 kg/d) throughout the lactation (LLL); low intakes (<5 kg/d) in the first week, then gradually increased throughout the rest of the lactation period (LHH); gradual increase in intake throughout lactation with no drop and a peak intake after d 10 of lactation (Gradual); rapid increase in intake with no drop and the peak intake met before d 10 (Rapid); a major drop in feed intake (> 1.6 kg decrease for ≥ 2 d) any time during lactation (MAJOR); minor drop (≤ 1.6 kg for ≥ 1 day) (MINOR). These categories were adapted from those originally described by Koketsu et al., 1997 (doi:10.1016/S0301-6226(97)00050-X).

FEED INTAKE BY PARITY ON SOW AND LITTER PERFORMANCE

As intended, ADFI increased (P < 0.01) as feed intake level increased from Low (5.74 kg/d) to Average (7.05 kg/d) and High (7.71 kg/d, Table 4). Average daily feed intake also increased (P < 0.01) as parity increased from P1 (5.48 kg/d) to P2 (6.85 kg/d), to P3+ (8.17 kg/d). There was an interaction between parity and intake category (P < 0.01, Fig. 3). Intake increased across each category within each parity, and the magnitude of differences among Low intake sows and High intake sows ranged between 2.5 kg (Low intake) and 2.8 kg (High intake).

Within each category, feed intakes increased (P ≤ 0.05) across all three parities for all three intake categories (Fig. 3). There was no difference (P = 0.13) in average daily feed intake of P1 Average sows (5.8 kg/d) and P2 Low sows (5.7 kg/d). The same interaction pattern occurred for metabolizable energy intake (Fig. 4).

FIGURE 3

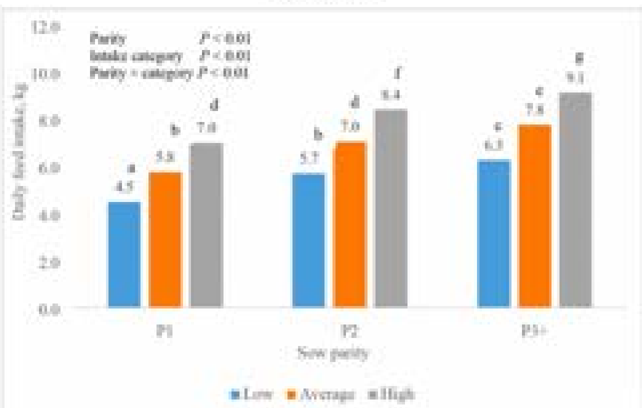
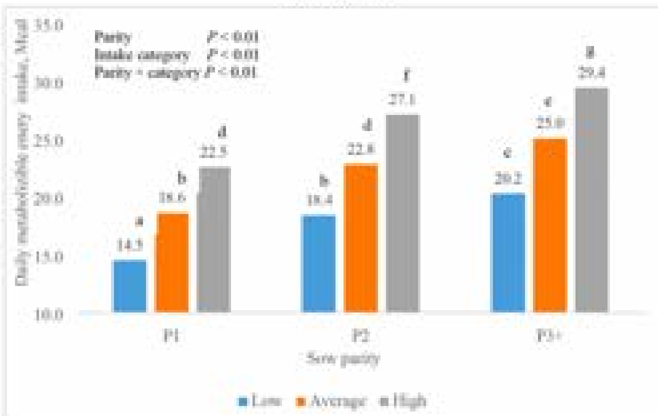


FIGURE 4



Metabolizable energy intake for P1 Average sows (18.6 Mcal/d) did not differ (P = 0.19) from P2 Low intake sows (18.4 Mcal/d). Further, metabolizable energy intake for P1 High sows (22.5 Mcal/d) did not differ (P = 0.08) from P2 Average sows (22.8 Mcal/d). Average pig weaning weight was increased among parity (P < 0.01) and intake category (P < 0.01, Table 4).

The average pig weaning weight from P3+ sows (6.07 kg) was 0.15 kg heavier than pigs from P2 sows (5.92 kg, Table 4). The average pig weaning weight from P2 sows was 0.65 kg heavier than pigs from P1 sows (5.27 kg).

Pre-weaning mortality did not differ (P = 0.12) between P1 sows (14.77%) and P3+ sows (15.51%), but both were at least 1.82 percentage units greater (P ≤ 0.01) than P2 sows (Table 4).

Table 4. Main effects of sow average daily feed intake during lactation by parity and intake category

	Sow parity[1]			Intake category[1]				*P*-value		
Item	P1	P2	P3+	Low	Avg	High	SEM	Parity	Intake category	Parity × Intake cat.
Sows, n	1023	868	2357	1063	2124	1061				
Lactation length, d	21.60	21.40	21.50	21.46	21.58	21.46	0.77	0.30	0.23	0.59
Avg. daily intake, kg/d	5.74^{a}	7.05^{b}	7.71^{c}	5.48^{a}	6.85^{b}	8.17^{c}	0.04	<0.01	<0.01	<0.01
[2]SID Lysine intake, g/d	55.73^{a}	68.36^{b}	74.72^{c}	53.49^{a}	66.54^{b}	78.77^{c}	2.63	<0.01	<0.01	0.28
Energy intake, Mcal/d	18.55^{a}	22.77^{b}	24.89^{c}	17.72^{a}	22.14^{b}	26.35^{c}	0.18	<0.01	<0.01	<0.01
Avg. piglet wean wt, kg/pig	5.27^{a}	5.92^{b}	6.07^{c}	5.44^{a}	5.75^{b}	6.07^{c}	0.17	<0.01	<0.01	0.25
Pre-wean mortality, %	14.77^{b}	12.95^{a}	15.51^{b}	17.44^{c}	13.62^{b}	12.16^{a}	1.42	<0.01	<0.01	0.08
[3]Sow body weight after farrowing, kg	173.10^{a}	195.80^{b}	234.52^{c}	201.60	200.68	201.14	3.38	<0.01	0.55	<0.01
Sow body weight change, %	-2.19^{a}	-0.81^{b}	0.49^{c}	-3.47^{a}	-0.47^{b}	1.43^{c}	1.02	<0.01	<0.01	0.33
Wean-to-estrus interval, d	6.32^{c}	5.80^{b}	4.86^{a}	5.36^{a}	5.54^{a}	6.09^{b}	0.28	<0.01	<0.01	0.38

a-c Treatments within a factor in the same row that do not share a superscript differ ($P < 0.05$).
[1]Sows were separated by parity (P1, P2, P3+) and into low (quartile 1; ≤ 25%), average (quartile 2-3), or high feed intake (quartile 4; ≥75%).
[2]SID - Standardized ileal digestible
[3]Sow body weight after farrowing = pre-farrow adjusted weight - conceptus weight. Pre-farrow adjusted weight = total piglets born × 0.085 × days until farrowing from time of weighing + pre-farrow weight. Conceptus weight = 0.3 + 1.329 × total piglets born × average piglet birth weight.

Sow body weight after farrowing became heavier with each parity category. Low intake P1 sows had the lightest body weight after farrowing but were not different from Average intake P1 sows (P = 0.42). P2 sow body weights did not differ across intake categories (P ≥ 0.60). Average and High intake P3+ sows had lighter body weights after farrowing compared to Low intake P3+ sows (P < 0.001).

Low intake category sows lost weight during lactation regardless of parity. P1 sows lost 2.19% of their body weight during lactation, and P2 sows lost 0.81% during lactation. Contrarily, P3+ sows increased body weight by 0.49% during lactation (Table 4). P3+ sows (4.86 days) returned to estrus after weaning 0.94 days quicker (P < 0.0001) than P2 sows (Table 4). P2 (5.80 days) returned to estrus after weaning 0.52 days quicker (P = 0.03) than P1 sows.

Table 5. Main effects of sow subsequent farrowing performance during lactation by parity and intake category

	Sow parity[1]			Intake category[1]				*P*-value		
Item	P1	P2	P3+	Low	Avg	High	SEM	Parity	Intake category	Parity × Intake cat.
Subsequent total piglets born	15.09^{a}	16.25^{b}	16.31^{b}	15.38^{a}	15.92^{b}	16.34^{b}	0.44	<0.01	<0.01	0.77
Subsequent piglets born alive	13.90^{a}	14.64^{b}	14.10^{a}	13.80^{a}	14.26^{b}	14.58^{b}	0.41	0.01	0.01	0.43
Subsequent still births	0.92^{a}	1.27^{b}	1.86^{c}	1.34	1.33	1.38	0.20	<0.01	0.93	0.64
Subsequent mummies	0.27	0.34	0.34	0.26	0.32	0.36	0.07	13.00	0.07	0.99

a-c Treatments within a factor in the same row that do not share a superscript differ ($P < 0.05$).
[1]Sows were separated by parity (P1, P2, P3+) and into low (quartile 1; ≤ 25%), average (quartile 2-3), or high feed intake (quartile 4; ≥75%).

DISCUSSION

The impact of feed intake patterns during lactation and feed intake levels within parity on sow and litter performance and subsequent performance were examined. Inadequate daily feed intakes during lactation are associated with a reduction of sow body condition and reproductive failure (Koketsu et al., 1996b), increasing pre-weaning mortality rate and decreased piglet wean weights (Koketsu et al., 1996b,1997; Prunier et al. 1997; Sulabo et al., 2010) as well as compromised subsequent performance (Koketsu et al., 1996b,1997; Kruse et al., 2011). Over conditioning due to caloric excess leads to locomotion problems and reductions in subsequent performance (Dourmad et al., 1994). In addition to such wide variation in ADFI, sows also differ in their daily intake patterns (Koketsu et al., 1996a,1997). These intake patterns were characterized almost three decades ago, and most likely do not represent production practices, feed ingredients, or genetics of sows raised on a modern commercial farm today. Given previous results, the hypothesis was that sows that consume consistently low feed intakes throughout lactation would have poorer body condition, greater pre-wean mortality rates, wean fewer pigs, and have compromised subsequent farrowing performance. Conversely, sows that have adequate daily intake during lactation have improved current and subsequent sow and litter performance.

In agreement with this hypothesis, sows that had consistently low intakes throughout lactation (LLL) had a significant reduction in pig weaning weights, a greater percentage of pre-wean mortality, and took more than a day longer to return to estrus compared to sows with other feed patterns during the lactation period.

This is likely due to these sows receiving inadequate Lys, metabolizable energy, or both (Dourmad et al., 1994). Sow diets are commonly formulated to meet the requirements of the average sow (daily feed consumption of approximately 6.8 kg/d), leaving approximately 20% of the population, with a feed consumption closer to 5.4 kg/d, deficient in lysine and energy. These key nutrients are necessary to support sow performance and prevent culling in the herd. Sows that had rapid and gradual intake patterns had significant improvements to overall performance compared to the consistently low intake sows or sows that had low intakes the first week and then gradually increased consumption. Sows that experienced a major or minor drop in feed intake during the lactation period had slight reductions in performance, yet still performed better than the low intake sows.

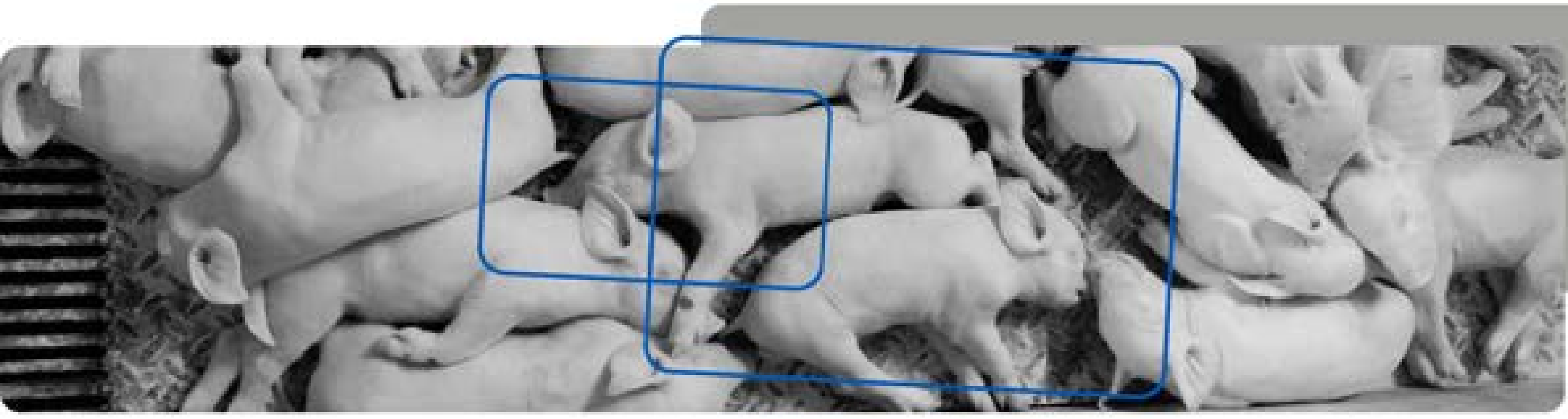
Several studies have explored the influence that parity has on sow and litter performance. However, the interaction between parity and lactation level intake on sow and litter performance, and subsequent performance, is less understood. What is understood is that younger sows, that are still maturing and growing, do not consume the same amount of feed as older sows (Gourdine et al., 2004; Strathe et al., 2017; Piñeiro et al., 2019). Therefore, it was not surprising that young sows had reductions in average daily feed intake and in lysine and energy consumption that likely contributed to the reductions in average pig weaning weight, subsequent total born, and increased pre-wean mortality. Young sows also had lighter body weights after farrowing and had greater loss of body weight during lactation. As intake level increased from low, average, and high, performance continued to improve within parity.

CONCLUSIONS

These data indicate that feed intake patterns are important in allowing producers to target under-consuming sows that potentially become lysine deficient as a way to ameliorate early culling of young of sows, lessen pig fallout during lactation, and improve overall litter performance. Sows that have consistently low feed intake throughout lactation have greater pre-wean mortality and wean fewer pigs. Body condition and subsequent performance of these sows are also compromised. Low feed intakes within parity proved detrimental to the performance of young sows, but also the consequences of not consuming enough feed even in cases of mature sows. Understanding which sows fall into these categories may allow nutritionists to formulate diets that cater specifically to these groups and may mitigate the negative impacts on sow and litter performance, leading to increased sow retention.

DISCLOSURES

The independent trials that comprise this research were from a combination of sponsored private industry research trials and competitive grant funding. The authors declare this summary was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



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