# Swine Update

Kansas State University Agricultural Experiment Station
and Cooperative Extension Service

Animal Sciences & Industry

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## SWINE DAY

Kansas State University•Thursday, November 19•Manhattan Holiday Inn & Holidome

**8:15–9:15 a.m. Trade Show—Holidome Lobby**

**Morning Program—Ballroom**

| | |
|---|---|
| | Master of Ceremonies—Duane Davis |
| 9:20 | Welcome—Jack Riley |
| 9:30 | *Expander Processing of Swine Diets*—Joe Hancock |
| | *Environmental Diet Formulation*—Bob Goodband |
| | *Breakthroughs in Nutritional Manipulation of Pork Quality*—Jim Nelssen |
| | *Managing Weight Variation: In Nursery Placement and Marketing*—Steve Dritz |
| | *K-State Nutritional Audits: A Complete Assessment of Your Feeding Program*—Mike Tokach |
| **11:30** | **LUNCH** |

**Afternoon Program—Ballroom**

| | |
|---|---|
| | Master of Ceremonies—Pat Murphy |
| 1:30 | *The Pork Business in the Next Millennium*—Al Tank, Chief Executive Officer, National Pork Producers Council |
| 2:30 | *Mini Research Presentations* |

K-STATE Kansas State University

# Dietary Valine Increases Litter Weaning Weights

### *Introduction*

Increased genetic selection and improvements in management have dramatically increased the production capability of the modern commercial sow. High producing sows require considerably greater levels of amino acids to support increased milk production than sows with low litter weaning weights. Recently, research conducted at Kansas State University has found that increasing total dietary valine from .75 to 1.15% in lactation diets resulted in increased litter weight gain. Research has also observed that increasing both dietary valine and isoleucine in lactation diets increased litter weaning weights. Therefore, the objective of this experiment was to determine if the improved litter weaning weights observed with the increased dietary valine was specific for valine or if other branch chain amino acids (isoleucine or leucine) will also improve litter weaning weights.

### *Procedures*

Three hundred-six sows were fed one of eight dietary treatments arranged as a 2×2×2 factorial. Main effects included 2 levels of valine (.80 and 1.20%), isoleu-

**Table 1. The Effects of Increasing Isoleucine, Leucine and (or) Valine on Litter Growth Performance[a]**

| Item | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Valine, % | .80 | | | | 1.20 | | | | |
| | Isoleucine, % | .68 | | 1.08 | | .68 | | 1.08 | | |
| | Leucine, % | 1.57 | 1.97 | 1.57 | 1.97 | 1.57 | 1.97 | 1.57 | 1.97 | |
| Item | TBCAA, %[b] | 3.05 | 3.45 | 3.45 | 3.85 | 3.45 | 3.85 | 3.85 | 4.25 | SE |
| No. of sows | | 40 | 38 | 39 | 38 | 38 | 36 | 36 | 41 | – |
| Mean parity | | 2.0 | 2.2 | 2.1 | 2.1 | 2.0 | 2.3 | 2.2 | 2.1 | .14 |
| No. of pigs after fostering | | 11.1 | 11.2 | 11.3 | 11.1 | 11.3 | 11.2 | 11.1 | 11.0 | .16 |
| No. of pigs weaned | | 10.6 | 10.5 | 10.5 | 10.6 | 10.6 | 10.5 | 10.6 | 10.6 | .13 |
| Lactation length,[d] | | 20.5 | 20.9 | 20.7 | 20.8 | 21.0 | 20.8 | 20.8 | 20.6 | .24 |
| Litter wt, lb | | | | | | | | | | |
| Day 2 | | 42.8 | 42.3 | 44.1 | 43.7 | 43.7 | 45.0 | 43.0 | 44.3 | .95 |
| Day 7[d] | | 65.8 | 64.5 | 66.9 | 66.5 | 68.5 | 69.0 | 66.1 | 67.9 | 1.46 |
| Day 14[d] | | 103.1 | 102.2 | 105.7 | 103.8 | 108.2 | 108.1 | 103.5 | 107.2 | 2.22 |
| Weaning[cd] | | 135.9 | 135.6 | 138.8 | 139.2 | 143.4 | 142.5 | 138.3 | 143.0 | 2.88 |
| Litter wt gain, lb | | | | | | | | | | |
| Day 2 to 7[d] | | 22.9 | 22.0 | 22.9 | 22.9 | 24.9 | 24.0 | 23.1 | 23.6 | .88 |
| Day 2 to 14[d] | | 60.2 | 59.7 | 61.5 | 60.2 | 64.6 | 63.1 | 60.6 | 63.1 | 1.79 |
| Day 2 to weaning[cd] | | 93.3 | 93.3 | 94.9 | 95.6 | 99.7 | 97.6 | 95.3 | 98.9 | 2.48 |

Statistical analysis ( P <)

| | Interactions | | | | Main effects | | |
|---|---|---|---|---|---|---|---|
| Item | Val×Ile×Leu | Ile×Leu | Val×Leu | Val×Ile | Leu | Ile | Val |
| Mean parity | .89 | .18 | .73 | .79 | .30 | .99 | .50 |
| No. of pigs after fostering | .78 | .43 | .60 | .32 | .57 | .45 | .84 |
| No. of pigs weaned | .94 | .46 | .92 | .85 | .60 | .97 | .70 |
| Lactation length,[d] | .69 | .65 | .19 | .48 | .81 | .95 | .55 |
| Litter weights | | | | | | | |
| Day 2 | .96 | .99 | .18 | .15 | .51 | .67 | .29 |
| Day 7 | .92 | .58 | .33 | .11 | .88 | .94 | .06 |
| Day 14 | .44 | .65 | .31 | .12 | .91 | .83 | .05 |
| Weaning | .54 | .44 | .63 | .17 | .62 | .81 | .03 |
| Litter weight gain | | | | | | | |
| Day 2 to 7 | .82 | .36 | .88 | .27 | .64 | .55 | .05 |
| Day 2 to 14 | .32 | .57 | .59 | .25 | .83 | .61 | .06 |
| Day 2 to weaning | .47 | .36 | .91 | .32 | .76 | .91 | .04 |

[a] Litter size after cross-fostering was used as a covariate.
[b] Total branched-chain amino acids (isoleucine + valine + leucine).
[c] Lactation length was used as a covariate.
[d] Parity was used as a covariate.

cine (.68 and 1.08%) and leucine (1.57 and 1.97%). All sows were maternal line (PIC Line C-22) and were bred to terminal line (PIC Line 326 ) boars. Treatments were randomly allotted within groups of eight as sows farrowed to minimize variation in lactation length between treatments. Litter size was equalized by 24 h after farrowing, and all sows began the study with at least 10 pigs. Sows were allowed ad libitum access to feed and water from parturition until weaning. Creep feed was not offered to litters. Pigs and sows were weighed at d 0, 7, 14, and weaning (d 21). The lactation diets were formulated to meet or exceed amino acid requirement estimates based on ratios relative to lysine, except for valine, isoleucine, and leucine. All other nutrients were in excess of published requirement estimates. Diets were formulated to .90% total lysine, .90% Ca, and .80% P. The control diet was formulated to contain .80% valine, .68% isoleucine and 1.57% leucine. Cornstarch was replaced in .40% increments with L-valine, L-isoleucine, L-leucine or a combination of each to provide the remaining seven experimental diets. The treatments included two levels of valine (.80 and 1.20%), isoleucine (.68 and 1.08%), and leucine (1.57 and 1.97%).

### *Results*

Increasing dietary valine, isoleucine, or leucine had no effect on number of pigs weaned ($\bar{x}$ = 10.6; Table 1) or survival rate after cross-fostering ($\bar{x}$ = 94.5%). When comparing main effects, increasing dietary valine from 47.52 to 63.87 g/d (.80 to 1.20%, regardless of isoleucine or leucine, increased ($P < .06$) litter weights throughout each week as well as the overall 21 d lactation period. Sow ADFI ($P > .50$) and sow weight loss ($P > .30$) were not affected by dietary valine; however, increasing dietary valine increased, sow backfat loss increased ($P < .02$; data not shown).

Neither dietary isoleucine nor leucine had any effect ($P > .10$) on litter weights, litter weight gains, and sow backfat change. Sow weight loss ($P < .15$) tended to be less for sows fed increased leucine. Neither isoleucine nor leucine had any effect on sow ADFI ($P > .58$).

### *Discussion*

Increasing dietary valine from .80% to 1.20% increased litter weaning weight by 4.4 lb and litter weight gain from d 2 to weaning by 3.7 lb, independent of dietary isoleucine and leucine. This suggests that increasing dietary valine increases milk production as measured by litter weaning weights regardless of dietary isoleucine or leucine. This response to valine has been observed in previous experiments conducted with high producing sows at Kansas State University. In an experiment reported in the 1994 KSU Swine Day Report of Progress, as valine increased from .75 to 1.15%, litter weaning weights linearly increased 8.2 lb and litter weight gain increased 7.5 lb. In our experiment, no change in sow weight or ADFI was observed when additional valine was added. There was, however, an increase in last rib backfat loss, which at .06 in, was minimal. Previous research has elicited the same response for sow weight change and ADFI; however, there was no change in last rib backfat depth.

Previous research has reported that increasing isoleucine from .50 to 1.20% increased litter weaning weight, with the greatest response in litter weaning weight achieved when isoleucine was increased from .50 to .85%. The isoleucine level of .85% in that experiment is intermediate to our levels of .68 and 1.08%. Our data does not necessarily refute the previous data as we observed a numerical increase in litter weaning weight and litter weight gain when sows were fed the low level of valine (.80%) and the high level of isoleucine (1.08%).

Our study shows no response to the addition of leucine. Diets formulated to meet conventional lysine requirements don’t appear to be deficient in leucine.

The valine requirement of high-producing lactating sows appears to be greater than current National Research Council and Agricultural Research Council estimates. The increase in litter weights and litter weight gain with increased valine, independent of isoleucine and leucine, indicates that the response is due entirely to valine and not to the total branched chain amino acid level of the diet. In conclusion, leucine and isoleucine did not elicit the same magnitude of response, thus, the importance of valine for milk production must be considered when formulating lactation diets.

Attend SWINE DAY!

Thursday, November 19

Manhattan Holiday Inn & Holidome

*See Page 1 for Program Details!*

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SWINE UPDATE

## *UPCOMING EVENTS*

KSU Swine Industry Day
Manhattan, KS
November 19

Jim L. Nelssen
Extension Specialist
Swine

Robert D. Goodband
Extension Specialist
Swine

Mike D. Tokach
Extension Specialist
Livestock Production
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Steve Dritz
Swine Specialist
Food Animal Health and
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