# Effect of Neonatal Birth Weight on Subsequent Growth Traits in Large White x Landrace Commercial Breeding Gilts

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China Supakorn, Postdoctoral Researcher, Department of Animal Science, Iowa State University;
Clay Lents, Supervisory Research Physiologist, USDA, U.S. Meat Animal Research Center, Reproduction Research Unit, Clay Center, NE 68933;
Grace Moeller, Graduate Research Assistant, Department of Animal Science, Iowa State University;
Jeffrey L. Vallet, Supervisory Research Physiologist, USDA, U.S. Meat Animal Research Center, Reproduction Research Unit, Clay Center, NE 68933;
Terry J. Prince, Nutritionist , Prince Nutrition Service LLC, 1550 Dumbar Court, Auburn, AL 36830;
Christine E. Phillips, Assistance Director of Production Research, Murphy Brown, LLC, 4134 Hwy 117 S, Rose Hill, NC 28458;
R. Dean Boyd, Technical Director for The Honor Company, Spring Green, WI;
Ashley E. DeDecker, Director of Production Research, Murphy Brown, LLC, 4134 Hwy 117 S, Rose Hill, NC 28458;
Kenneth J. Stalder, Professor, Department of Animal Science, Iowa State University

### Summary and Implications

The objective of the study was to determine neonatal birth weight effects on gilt development growth performance. Data were collected from 1,052 litters housed at Circle 4 Farms, Milford, UT. A total of 2,960 crossbred Large White x Landrace maternal line gilts entered the research Gilt Development Unit (GDU). Gilts were categorized by their individual neonatal birth weight into 3 groups Group I (≤ 1.1 kg; n=772), Group II (1.2 to 1.5 kg; n=1,356), and Group III (≥ 1.6 kg; n=832). Growth trait least square means (±SE) for each birth weight group were analyzed using PROC GLM. Fixed effects in the model included birth weight, week of birth and development diet with the random effect of pen within a room and common litter effect. When evaluating body weight (BW) at puberty, a fixed effect for the utilization of PG600 (yes or no) was included in the model. Neonatal birth weight group was a significant ($P<0.05$) source of variation for gilt growth in development. Gilts from the heaviest birth weight group (Group III) had significantly ($P<0.05$) larger weaning weight (7.2±0.1 kg), BW at 100 d (45.1±0.3 kg), BW at 142 d (74.3±0.4 kg), BW at 160 d (89.9±0.5 kg) and BW at 200 d (125.7±0.7 kg), faster average daily gain (0.81±0.005 kg/d), and larger BW at puberty (137.7±0.7 kg) when compared to Group I and II. Improving neonatal birth weight will improve gilt development and body weight through puberty.

### Introduction

Over the last 20 years, extremely prolific or hyperprolific sows have been introduced in swine breeding schemes worldwide. In the U.S., the number of piglets born alive has increased from less than 10.2 per litter in 1998 up to 13 per litter in 2018. However, selection for sow's ability to give birth to a high number of piglets has led to an increased within-litter variation in piglet's birth weight. A low birth weight combined to a high within-litter birth weight variation was shown to be negatively associated with perinatal survival. Few studies have evaluated the impact of varying birth weight on subsequent growth traits.

The objective of this study was to quantify the effect of birth weight analyzed as a categorized trait on future body weight and daily gain in the modern commercial U.S. swine production system.

### Materials and Methods

A total of 2,960 crossbred Large White x Landrace maternal line neonatal piglets were born in Smithfield Hog Production Division facilities (Circle 4 Farms, Milford, UT). They were weighed at birth and uniquely identified with an ear tag. The female piglets remained with their birth sow. At weaning, body weight of piglets was recorded and weaned gilt piglets were transported to the research GDU. Gilts were enrolled on study at 100 days and they fed different dietary treatments. Diets contained similar amounts of metabolizable energy (ME; average 3,200 kcal/kg) but differed in levels of standard ileal digestible (SID) lysine. Diets were fed in two phases: Phase 1, 100 days through 142 days of age; Phase 2, 143 days through 200 days of age. Dietary treatments were designated as Low (SID lysine; phase 1, 0.68%; phase 2, 0.52%), Medium (SID lysine; phase 1, 0.79%; phase 2, 0.60%), and High (SID lysine; phase 1, 0.90%; phase 2, 0.68%). The crossbred LW x LR gilts were moved to a breeding herd and were evaluated for body weight at puberty. All gilts at 220 d expressing silent heat or anestrus were injected with PG600 2 ml (MERCK Animal Health, USA) and observed for 1 wk to determine their estrus expression. Individual body weight for each gilt was recorded using digital scale (Digi-Star SW4600EID Digital RFID, VID Recording scale; Digi-Star LLC, Fort Atkinson, WI) and average daily gain (ADG) at 100 and 200 d was measured using body weight gain divided by 100 d.

Birth weight was categorized into 3 groups considering means and standard deviation (SD) of datset: Group I (≤ 1.1 kg; n=772), Group II (1.2 to 1.5 kg; n=1,356), and Group III (≥ 1.6 kg; n=832), respectively. Averages for each group were 1.0, 1.4, 1.8 kg for Group I, II, and III, respectively. Data were analyzed using a generalized linear model (GLM; SAS version 9.4). Models implemented to evaluate growth performance included fixed effects: birth weight, week of birth and developmental dietary lysine levels and random effect: pen within a room. These fixed effects were evaluated for differences at P value of 0.05 or less when the fixed effect was a significant source of model variation. The individual means for each level of birth weight fixed effect were separated using the PDIFF option.

## Results and Discussion

Effect of birth weight showed significant different in growth performance ($P<0.05$). Least square means±standard errors is represented in Table 1. Neonatal birth weight in Group III showed remarkably greater BW from individual weaning to puberty ($P<0.05$). Average daily gain of neonatal piglet from 100 to 200 d was 0.77±0.005, 0.80±0.004 and 0.81±0.005 kg/d for Group I, II, and III respectively. Neonatal piglets in Group I had lowest ADG when compared to others ($P<0.05$).

Differences in neonatal birth weight are perpetuated. Lighter pigs at birth (Group I) were still lighter in subsequent growth performance until puberty. Producers should consider alternatives for managing (split suckling or crossfostering) underweight pigs on an individual herd basis.

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**Table 1.** Least square mean (±SE) for body weight (BW) among neonatal birth weight groups in Large White x Landrace maternal line gilts

| Traits | Neonatal birth weight group | | |
|---|---|---|---|
| | Group I (≤ 1.1 kg) | Group II (1.2 to 1.5 kg) | Group III (≥ 1.6 kg) |
| Weaning weight (kg) | 5.5±0.1[a] | 6.4±0.1[b] | 7.2±0.1[c] |
| BW at 100 d (kg) | 38.2±0.4[a] | 41.9±0.2[b] | 45.1±0.3[c] |
| BW at 142 d (kg) | 65.2±0.6[a] | 70.0±0.3[b] | 74.3±0.4[c] |
| BW at 160 d (kg) | 79.9±0.8[a] | 85.1±0.4[b] | 89.9±0.5[c] |
| BW at 200 d (kg) | 113.6±0.9[a] | 120.9±0.5[b] | 125.7±0.7[c] |
| BW at puberty (kg) | 129.2±0.7[a] | 135.5±0.7[b] | 137.7±0.7[c] |

[a-c] denotes significant difference among neonatal birth weight groups ($P<0.05$).