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Comparison of heart girth or flank-to-flank measurements for predicting sow weight (2004)

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COMPARISON OF HEART GIRTH OR FLANK-TO-FLANK MEASUREMENTS FOR PREDICTING SOW WEIGHT

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Summary

In previous Swine Day Reports we have demonstrated that feeding sows in gestation on the basis of body weight and backfat thickness is more precise and economical than methods of feeding based on visual observation of body-condition score. To simplify the weight and backfat procedure, we have estimated sow weight based on the correlation between heart girth (circumference of the sow measured behind the front legs) and weight. The objective of this study was to determine if a different sow measurement, flank to flank, would be as accurate as the heart-girth measurement. Sows were weighed and measured behind the front legs for heart girth or in front of the back legs for flank-to-flank measurement, and regression equations to estimate sow weight were developed. A total of 605 sows from three farms were used for the girth measurement. A total of 306 sows from two farms were used for the flank-to-flank measurement. The heart-girth equation was: weight, lb = 21.54 × heart girth, in – 684.76. The flank-to-flank measurement was: weight, lb = 26.85 × flank-to-flank, in – 627.93. The average residual was 30.8 lb for the heart girth measurement and 31.4 lb for the flank-to-flank measurement. Both of these measurements provide a reasonable weight estimate that can be used to determine weight categories for more accurately feeding gestating sows.

(Key Words, Heart Girth, Pigs, Prediction Equations, Sows, Weight.)

Introduction

Determining the proper feeding rate for gestating sows in commercial farms has been challenging. Body-condition score often has a poor relationship with the backfat value of the sow. Also, because 80 to 90% of the energy requirement is for maintenance in gestation, determining the energy requirement of the sow is important. Research has demonstrated that the maintenance requirement is closely related to sow weight. But sow weight unfortunately is not easy to determine in farms because of the inability to easily and efficiently weigh sows. If methods to estimate sow weight could be developed, feeding programs could more easily account for the differences in maintenance requirements of sows of differing body weights. The goal of this project was to develop regression equations to estimate sow weight from girth or flank measurements, and to determine whether these equations could accurately estimate sow body weight.

Procedures

Sows from three farms were used in this project. Girth was measured on sows at all three farms, and flank measurements were taken on sows at two of the farms. In total,

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605 sows were used for the girth measurements and 306 sows were used for the flank measurements. On all farms, sows were removed from the gestation stall and weighed on a platform scale. The girth and flank measurements were obtained while sows were in their gestation stall. Girth was measured by using a cloth tape measure. Girth was defined as the circumference of the sow immediately behind the front legs and in front of the first mammary glands (Figure 1). Flank-to-flank measurement was taken immediately in front of the hind legs by using the cloth tape measure. This measurement was defined as the measurement from the bottom of the flank on one side to the bottom of the flank on the other side, with the cloth tape being placed over the top of the hip (Figure 2).

Regression equations to predict body weight based on girth or flank measurement were developed by using the Proc Mixed procedure of SAS. Farm (three farms for girth and two farms for flank to flank) was included in the statistical model as a random variable to account for farm-to-farm variability. Residuals were calculated for both girth and flank-to-flank measurements to estimate the accuracy of the equations. The residuals were calculated as the absolute value of the difference between predicted weight using the developed regression equations and actual weight measured with the scale.

Results and Discussion

Both the girth and the flank-to-flank measurements were positively related with body weight (Figures 3 and 4). The heart-girth equation was: weight, lb = 21.54 × heart girth, in – 684.76. The flank-to-flank measurement equation was: weight, lb = 26.85 × flank-to-flank, in – 627.93.

The average residual was 30.8 lb for the heart-girth measurement and 31.4 lb for the flank-to-flank measurement. The median residual was 25.7 for girth and 26.0 for flank-to-flank measurement, which indicates that 50% of the sows had their weight predicted within 26 lb of their actual weight by using either equation (Table 1), and 75 and 90% of the sows had their weight predicted within 43 and 66 lb, respectively, of their actual weight. Comparison of the residuals indicates that the girth or flank measurements have similar accuracy.

As discussed in the introduction, one of the goals of developing a method to estimate weight is to be able to feed sows more accurately in the gestation barn. To do this, we need to categorize sows into weight categories. The weight categories shown in Table 2 have been used for our sow gestation feeding programs. The girth and flank-to-flank equations from this experiment were used to develop the categories to match each weight category. The relationship between the weight and measurement category, and the actual weights and measurements, are shown in Figures 5 and 6.

Another way to view this data is to calculate the percentage of sows that are placed in the correct weight category after measuring girth or flank to flank and the percentage of sows that are over- or under-estimated for weight and placed in the wrong category (Table 3). For girth, 66% of the sows were placed in the correct category, with 19.8% and 13.7% being under- and over-estimated for weight, respectively. Only one of the 605 sows was two categories off of the correct estimate. All other sows that were under- or over-estimates were within one category of the correct weight. For flank-to-flank measurements, 72% of the 306 sows were placed in the correct weight category, with 13 and 14% being under- and over-estimated, respectively. This analysis indicates that using either method to estimate weight would correctly classify similar numbers of sows. In agreement with the analysis of residuals, this indicates that the accuracy of the two methods is similar.

Girth measurement has been used for many years, across many species, as a rapid and easy measure to estimate body weight. For sows housed in a gestation crate, however, the girth measurement is not easily obtained because the front of the sow is not easily accessible. With most crate designs, the rear of the sow is easily accessible to obtain the flank-to-flank measurement. Therefore, the flank-to-flank measurement can be obtained faster, with less risk of operator injury and with the same accuracy as girth measurement, although either method should provide a more accurate estimation of body weight than visual estimation would.

Figure 1. The Heart-Girth Measurement.

Figure 2. The Flank-to-Flank Measurement.

Table 1. Residual of Sow Weight (Difference Between Predicted and Actual Weight)

Percentile	Girth, lb	Flank-to-flank, lb
25th	13.6	14.2
50th	25.7	26.0
75th	42.6	42.9
90th	65.0	66.3

Table 2. Weight Categories and Corresponding Girth and Flank-to-flank Measurements

Weight, lb	Girth, in	Flank to flank, in
< 325	< 46.9	< 35.5
325 to 400	47.0 to 50.4	35.6 to 38.0
400 to 475	50.5 to 54.0	38.1 to 41.0
475 to 550	54.1 to 57.5	41.1 to 44.0
> 550 lb	> 57.6	> 44.1

Table 3. Percentage of Sows that were Accurately Categorized or Under- or Over-estimated for Weight Category

	Weight Category					
	1	2	3	4	5	Total
Girth measurement						
Correct category	1.7%	10.7%	12.4%	13.7%	27.9%	66.4%
Underestimated	- - -	2.3%	3.0%	5.6%	8.9%	19.8%
Overestimated	1.7%	3.5%	2.8%	5.8%	- - -	13.7%
Total	3.3%	16.5%	18.2%	25.1%	36.9%	100.0%
Flank-to-flank measurement						
Correct category	- - -	3.9%	13.7%	21.9%	32.7%	72.2%
Underestimated	- - -	- - -	1.0%	2.3%	10.1%	13.4%
Overestimated	- - -	3.6%	6.5%	4.2%	- - -	14.4%
Total		7.5%	21.2%	28.4%	42.8%	100.0%

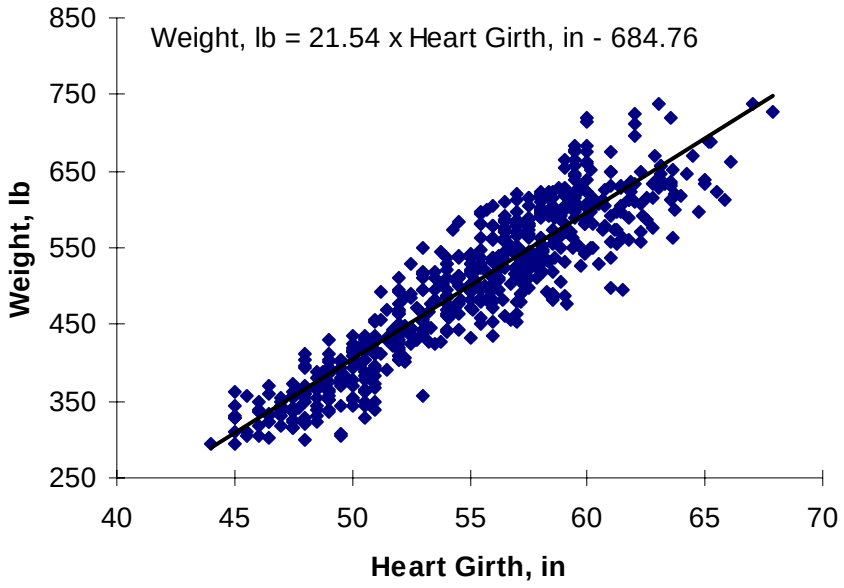

Figure 3. Relationship Between Heart Girth and Sow Weight (605 sows from 3 farms).

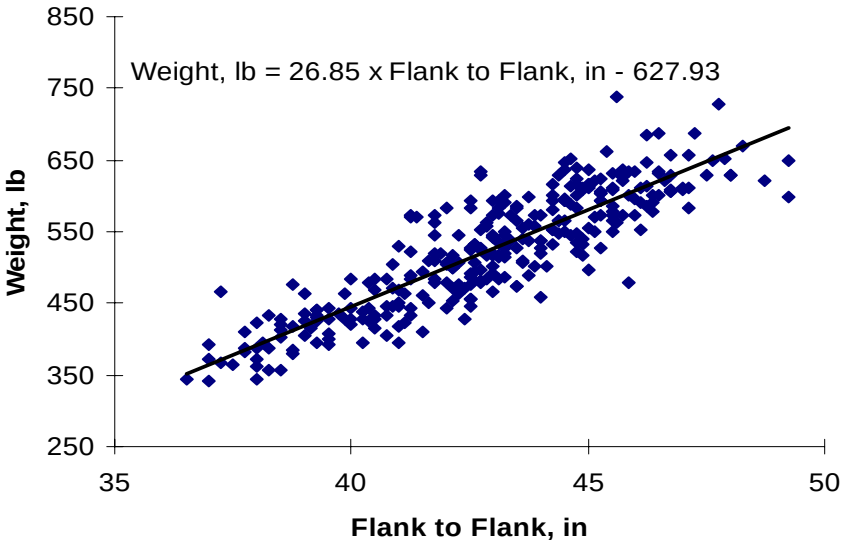

Figure 4. Relationship Between Flank-to-flank Measurement and Sow Weight (306 sows from 2 farms).

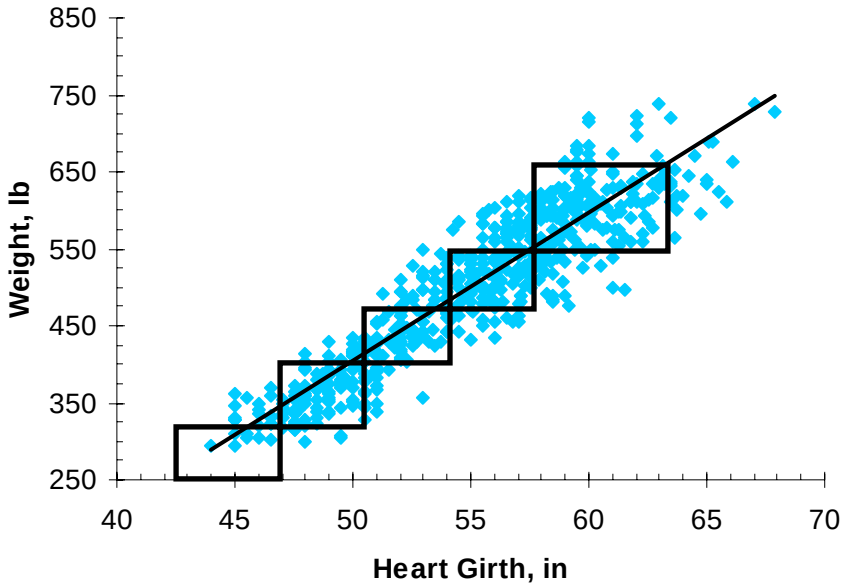

Figure 5. Weight Categories for Sow-Gestation Feeding Program by Using Heart Girth.

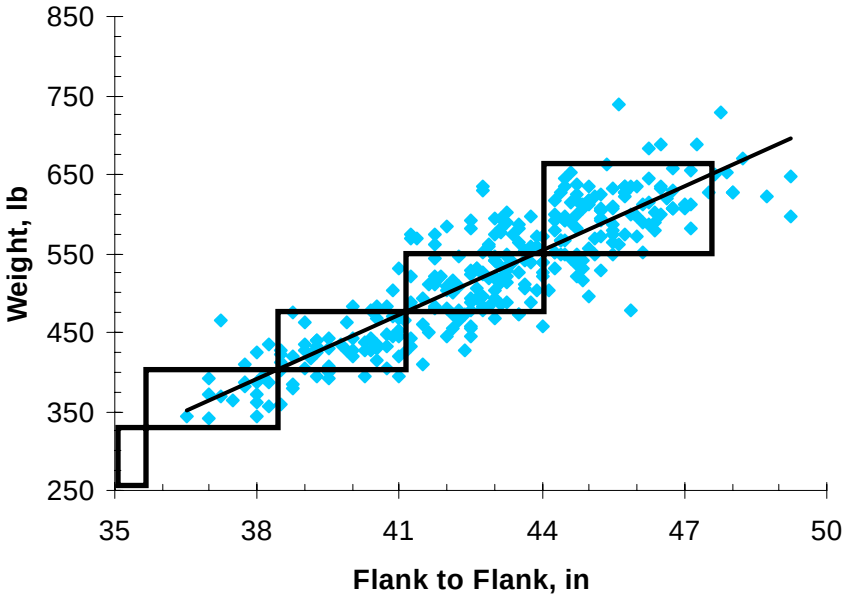

Figure 6. Weight Categories for Sow-Gestation Feeding Program by Using Flank-to-flank Measurement.