

Effect of Technician, Machine, and Animal Body Composition on Accuracy of Ultrasonic Measures of Backfat and Loin Muscle Area in Swine

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Summary and Implications

Records (n = 11,305) from the 1998 to 2003 National Swine Improvement Federation (NSIF) ultrasound certification programs were used to determine the effect of technician, machine (A-mode and B-mode: Aloka 500, Classic Scanner 200), and level of animal fat depth and loin muscle area on the accuracy of tenth rib off-midline backfat (BF10) and loin muscle area (LMA) measured on live pigs.

Introduction

Real-time ultrasound has become the method of choice to estimate body composition in live swine to select individuals to retain as breeding animals. In order to make genetic progress, accurate measurements of the traits of interest must be made. Accuracy of measuring backfat and loin muscle area using real-time ultrasound must then be investigated.

Materials and Methods

Data from the 1998 to 2003 National Swine Improvement Federation (NSIF) ultrasound certification programs were utilized in this study. Distribution of records by year and machine type are shown in Table 1. The NSIF certification program assesses an ultrasound technician's ability to accurately estimate carcass measures for backfat and loin muscle area. Technicians scan 50 pigs in the morning session (scan1) and return to scan the same group of pigs in the afternoon (scan2). After scanning, the pigs were harvested at a commercial packing facility and carcass data were collected by trained personnel. Standard Error of Prediction (SEP), a measure of accuracy, bias, and Standard Error of the Difference (SED), a measure of repeatability, are the three measures used to determine the certification status of technicians. The three measures are calculated as:

$$\text{bias} = \text{mean}(\text{scan} - \text{carcass})$$

$$\text{SEP} = \sqrt{\frac{\sum (\text{scan} - \text{carcass} - \text{bias})^2}{N-1}}$$

$$\text{SED} = \sqrt{\frac{\sum (\text{scan1} - \text{scan2})^2}{N-1}}$$

Certification standards were as follows:

Backfat: SEP- 3.81mm

SED- 3.81mm

bias- 3.81mm

Loin muscle area: SEP- 3.23 cm²

SED- 3.23 cm²

bias- 3.23 cm²

For the analysis of these data, a mixed linear model was utilized with a fixed effect for machine and carcass backfat and loin muscle area as covariates. Year and technician (n=78) nested within year were included as random effects. Dependent variables in the model were the difference between scan and carcass measures for BF10 (BFD) and LMA (LMD) and the absolute value of these differences (ABFD and ALMD, respectively). The absolute value of BFD and LMD were grouped into classes (n = 5) for each trait and pigs were grouped into two BF10 and two LMA groups for a frequency analysis. Technicians were classified by certification status as: failed to meet certification standards for BF10 and LMA; met certification standards for BF10; met certification standards for BF10 and LMA.

Results and Discussion

The effect of technician within year accounted for 25.1% and 52.8% of the variation in BFD and LMD, respectively. Technicians who failed to certify for BF10 had ABFD greater than 5.1 mm on 32% of the pigs measured while technicians who certified for BF10 had only 11% of measurements greater than 5.1 mm for ABFD. Technicians who certified for LMA had ALMD greater than 6.45 cm² on 5.5% of pigs while technicians who failed to certify had ALMD greater than 6.45 cm² on 24% of pigs measured. Across certification programs, technicians using A-mode machines had larger BFD and ABFD when compared to those using either B-mode machine. No difference was detected between the B-mode machines for LMD, but technicians using the Aloka 500 had larger ALMD than technicians using the Classic Scanner 200. Technician ability, machine type, and animal body composition did impact the accuracy of BF10 and LMA measured on live pigs.

Table 1. Distribution of records (number of technicians in parentheses) by year and machine type from the National Swine Improvement Federation ultrasound certification program

Machine	Year						Total
	1998	1999	2000	2001	2002	2003	
A-mode	800 (8)	0 (0)	98 (1)	100 (1)	0 (0)	0 (0)	998 (10)
Aloka 500	1980 (20)	1198 (12)	877 (9)	1000 (10)	774 (8)	1000 (10)	6829 (69)
Classic	300 (3)	500 (5)	1078 (11)	400 (4)	1000 (10)	200 (2)	3478 (35)
scanner 200							
Total	3080 (31)	1698 (17)	2053	1500 (15)	1774 (18)	1200 (12)	11305 (114)