

Time Required for Lameness Detection on an Embedded Microcomputer Based Force Plate in a Lab Based Setting

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Summary and Implications

The objective of this study was to determine the minimum time required for the embedded microcomputer based force plate (force plate) to detect lameness. The force plate can be placed under an electronic sow feeder or a gestation stall to routinely assess lameness. Previous work with the force plate has required sows to remain standing in a gestation stall for longer than a typical feeding time allotment of 9 minutes to measure the force applied to each foot. Comparing sows' weight distribution across time showed that an adjustment period is required before force distribution measurements are consistent, as the sows adapt to the force plate. When using a 30 second adjustment period, sows only needed to stand on the force plate for 210 seconds in order to have a consistent reading across time. This could create a labor reduction during research trials, and allow more data to be used from a commercial setting, than when using the previous times.

Introduction

Lameness in commercial sow herds is a common cause of compromised animal well-being. Currently, lameness is assessed visually, which is subjective and can result in discrepancies between different observers as to what sow is sound or lame. Therefore, a nonbiased lameness assessment is needed. In previous studies, the force plate successfully identified lameness in sows by measuring the force (weight) applied by the sow to each foot. Previous work required the sow to stand on the force plate between 15 and 30 minutes, which is not feasible in a commercial environment. Therefore, the objective of this study was to determine the minimum time a sow needs to stand on the force plate in order to detect lameness.

Materials and Methods

Twelve multiparous sows were injected with 10mg amphotericin B in the distal interphalangeal joint of either the left rear (LR) or right rear (RR) leg. Force distribution was measured using the embedded microcomputer based

force plate (force plate). The force plate used four unique quadrants to identify the individual force applied by each foot. The force plate's total dimensions are 1.5 m L x 5.6 m W x 0.5 m H, with a 6.4-mm thick aluminum plating comprising each quadrant. The force plate was installed under a gestation stall with a feeder at the front. Sows were walked into the stall and trickle fed to maintain the sows' attention for 15 minutes. Force measurements were recorded each half second from each quadrant. Sows were recorded on the force plate on the day before injection (-1), day after injection (+1), 6 days after injection (+6) and 10 days after injection (+10). After sows had returned to non-lame status and completed a 13 day washout period, sows were injected again in the opposite rear leg of their initial injection, this was repeated again after a 13 day washout period, so that each sow was injected twice in one rear leg and once in the other.

All sows were grouped by their injection site and their day relative to lameness injection for statistical analysis. Variables analyzed included mean weight placed on each foot, standard deviation, the 5th percentile of weight measurements (P5), the 95th percentile of weight measurement (P95), the range of the previous two measurements (P95-P5), and the skewness (SKEW) of the weight distribution. The 5th percentile of weight measurements and P95 were used in place of a minimum and maximum value to create a more meaningful number to compare across time. The minimum weight applied by a foot, with a recording every half second would be zero at some point in time while the sow was standing on the force plate. Additionally, P95-P5 was used in place of the true range to account for extreme values.

Results and Discussion

As sows first stepped onto the force plate the data recorded was variable. Figure 1 shows the pressure applied to each foot per minute on days -1 and +1 relative to lameness induction. Using an adjustment period where the first 30 sec were deleted helped to control initial variation in weight applied. After 12 min standing on the force plate, the sows' weight became increasingly variable as well, and therefore time measurements were compared to 10 min 30 sec. This was likely when the sows became full or restless. Sow weight distribution variables, per day and per injection site were compared across time to 10 min 30 sec for a total of 192 comparisons. The time that has the best relationship for measurement speed and accuracy was 30 to 210 sec after the sow has stepped onto the force plate, with an error rate of 3.6%. This will be useful in the future as we look at sows in a commercial setting, with varying stance times in an electronic sow feeder.

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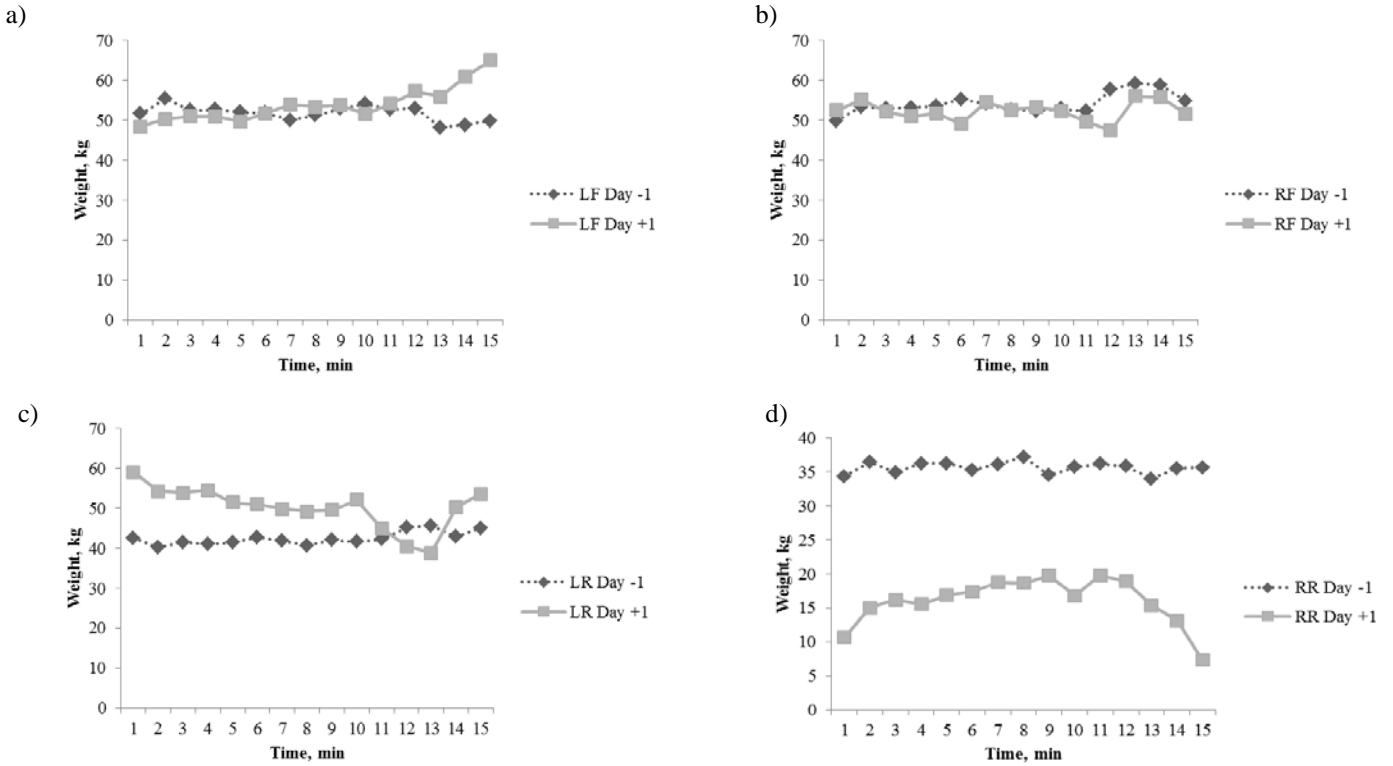


Figure 1. Average body weight applied per minute on the a) left front (LF), b) right front (RF), c) left rear (LR) and d) right rear (RR) foot on the day before and after lameness induction by injecting 10mg amphotericin B in the distal interphalangeal joint