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G. E. Nichols
Kansas State University, gage500@k-state.edu

K. M. Gourley
Kansas State University, Manhattan, kgourley@k-state.edu

J. M. DeRouchey
Kansas State University, Manhattan, jderouch@k-state.edu

See next page for additional authors

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Validation of Individual Computerized Sow Feeding Systems in Lactation

G.E. Nichols, K.M. Gourley, J.M. DeRouchey, J.C. Woodworth, M.D. Tokach, S.S. Dritz,[1] R.D. Goodband, and H.L. Frobose[2]

Summary

Two experiments evaluated the accuracy of individual computerized feed delivery systems for lactating sows (GESTAL Solo, JYGA Technologies Inc., St-Lambert-de-Lauzon, Quebec, Canada). The feeders volumetrically dispense feed based on rotations of a screw auger. In Experiment 1, 29 prototype feeders were used across 3 farrowing groups. On d 0, 1 feeder was selected to calibrate the computer system to the bulk density of the lactation diet. Feeders were programmed for 5 feeding periods per day with feeding period allowing up to 4 feed drops triggered by the sow. Sows activate a trigger within the feed bowl to receive a targeted amount of feed (1.5 lb) and the computerized feeder records the delivery amount based on calibration values. In addition, total lactation feed intake was recorded by weighing the quantity of feed provided to the feeding system for each sow throughout lactation. Feed delivered by a single trigger activation on d 0, d 10, and d of weaning was collected and weighed with a scale and compared to the computer record. Additionally, total feed delivered over the lactation period was compared between the recorded computer measurement and scale weight. Average percentage difference between the two measurements ranged from 0.01 to 36.6% for a single trigger event. Computer-recorded total lactation feed intake was marginally less ($P < 0.089$) than the actual weight of feed delivered (230.3 vs. 239.9 lb; SEM 5.43). Individual feeders had recorded total feed delivery ranging from 77 to 122% of actual weight delivered. Based on these results, a new feeder design, identical to the commercially marketed GESTAL Solo (plastic hopper manufactured with injection mold instead of rotational mold), was tested in Experiment 2. In Experiment 2, 29 feeders were used in a single farrowing group to evaluate the new sow feeders. Feeders were calibrated and data were collected using the same procedures as Experiment 1, except individual feed drops were collected 8 times per feeder throughout lactation. Average percentage difference across all feeders ranged from 3.8 to 13.4%. There was no evidence ($P < 0.542$) of difference between the computer-recorded total lactation feed and actual weight of feed delivered (279.6 vs. 272.8 lb; SEM 4.03). Individual feeders had recorded total feed delivery ranging from 90.4 to 106.4% of actual weight delivered. Overall, this study shows the new feeder model was less variable in feed drops and total feed delivery than the old prototype.

[1] Department of Diagnostic Medicine/Pathobiology, College of Veterinary Medicine, Kansas State University.

[2] Jyga Technologies, Quebec City, Quebec, Canada.

Introduction

Maximizing lactation feed intake is critical in maximizing litter growth performance and maintaining sow body condition. Nevertheless, increased diet costs necessitate consideration of novel methods to provide fresh lactation feed ad libitum while minimizing feed wastage.

Electronic lactation sow feeders are a relatively new technology that allow a producer to easily monitor, record, and control sow intake. One example of an electronic sow feeder used in lactation is the GESTAL Solo. This feeder allows for continuous feeding all day via sow activation and records feed delivery amounts. The feeder volumetrically dispenses feed based upon rotations of a feeder screw auger. The sow can trigger a feed drop by agitating a sensor within the feed pan causing the feeder to dispense a set portion of the sow's feed allotment based upon her feed intake curve. As this system measures the feed delivery amounts, it makes it easier to identify sows that are off feed, thus reducing labor directed toward identifying sick sows in lactation and ultimately improving herd health. It also delivers small meals that maintain feed freshness and promote maximum daily feed intake. Additionally, there is a stimulation component (30 g of feed dropped) that reminds sows when feed is available, which also encourages feed intake. The progression of development of these feeders has allowed for improvements to be made compared to the prototype feeders originally available.

Little information is available to understand the accuracy of electronic feeding systems used in lactation. Thus, in the present study, we aimed to evaluate the accuracy of this electronic lactation sow feeding system.

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved the protocols used in these experiments. The experiments were conducted at the K-State Swine Teaching and Research Center in Manhattan, KS.

Experiment 1

Twenty-nine GESTAL Solo (JYGA Technologies Inc., St-Lambert-de-Lauzon, Quebec, Canada) protoype feeders were evaluated over the duration of three farrowing groups between mid-January and mid-April 2016. One feeder (rotationally molded manufacturing) was selected to calibrate the computer system to the bulk density of the lactation diet (per manufacturer's instructions) when the sows entered the farrowing house. The computer system was programmed for 5 feeding periods per day, with up to 4 feeding drops (meals) per feeding period.

Two methods were used to validate the feeders. Individual feed drops were collected from each feeder on d 0 and 10 of lactation and on the day of weaning over the 3 farrowing groups for a total of 9 observations per feeder. Feed drops were collected as they were dispensed, weighed on a scale, and compared to the computer record of the amount of feed it dropped. To ensure consistency of feed drop weights, feed drops were collected at the same time each day. To account for difference in the meal size between feeders, the percentage difference between actual feed drop weight and computer recorded weight was calculated and divided by the actual feed drop weight.

The second method of validation tracked overall feed disappearance. Feed was weighed and added into large tubs in front of each feeder. This feed was then used to fill the feeder hopper daily. At the end of the lactation period, tubs were weighed to calculate total feed disappearance. Total feed disappearance from the tubs was compared to the total feed dispensed as recorded by the computer system.

Experiment 2

Due to improvements in design of the feeder (plastic hopper manufacturing was injection molded vs. rotational molded), new generation GESTAL Solo feeders were installed at the K-State Swine Teaching and Research Center. The second experiment was conducted over the course of one farrowing group in late September through early October 2016. Twenty-nine new model GESTAL Solo feeders were used. One feeder (injection molded manufacturing) was selected to calibrate the computer system to the bulk density of the lactation diet (per manufacturer's instructions) when the sows entered the farrowing house. The computer system was programmed for 5 feeding periods per day, with up to 4 feeding drops (meals) per feeding period.

Two methods were used to validate the accuracy of the feeders. Individual feed drops were collected from each feeder twice a week for 4 weeks, for a total of 8 observations per feeder. The procedures for collecting and measuring feed drop accuracy were the same as those described in Experiment 1. In addition, the second method for determining feed drop accuracy was the same as described for Experiment 1.

Data Analysis

Data were analyzed using the PROC GLIMMIX procedure of SAS (Version 9.4, SAS Institute Inc., Cary, NC). Feeder was used as the experimental unit. Results were considered significant at $P \leq 0.05$, and marginally significant at $P \leq 0.10$.

Results and Discussion

Experiment 1

The percentage difference between the computer recorded and the actual feed drop weight ranged from 0.01 to 36.6% (Figure 1) for a single trigger event. With the variation observed within the individual feed drop weights, it was expected that there would be variation between actual total lactation feed disappearance and the computer recorded amount. The computer recorded total lactation feed was marginally less ($P < 0.089$) than actual total lactation feed weight (230.3 vs. 239.9 lb, respectively; Figure 2). Individual feeders had recorded total feed delivery ranging from 77 to 122% of the actual total feed weight that was measured (Figure 3).

Experiment 2

The percentage difference between the computer recorded weight and the actual feed drop weight ranged from 3.8 to 13.4% (Figure 4) for a single trigger event, and was numerically less than the values observed in Experiment 1.

Although variation was still observed in a single feed drop between the actual weight and computer weight, there was no evidence of difference ($P < 0.542$) between total lactation feed recorded by the computer or by actual weight of feed delivered (279.6

vs. 272.8 lb; Figure 5). Individual feeders had recorded total feed delivery ranging from 90.4 to 106.4% of actual feed disappearance (Figure 6).

Overall, this study shows that the new generation GESTAL Solo feeders decreased the variation in percentage difference between actual feed disappearance and computer recorded feed delivery. Although variation between feed drops still existed in Experiment 2, there was no evidence for difference in total lactation feed delivered between the two. Overall, these trials would suggest that the new generation GESTAL Solo is a viable solution to accurately dispense feed to lactating sows and support maximum feed intake.

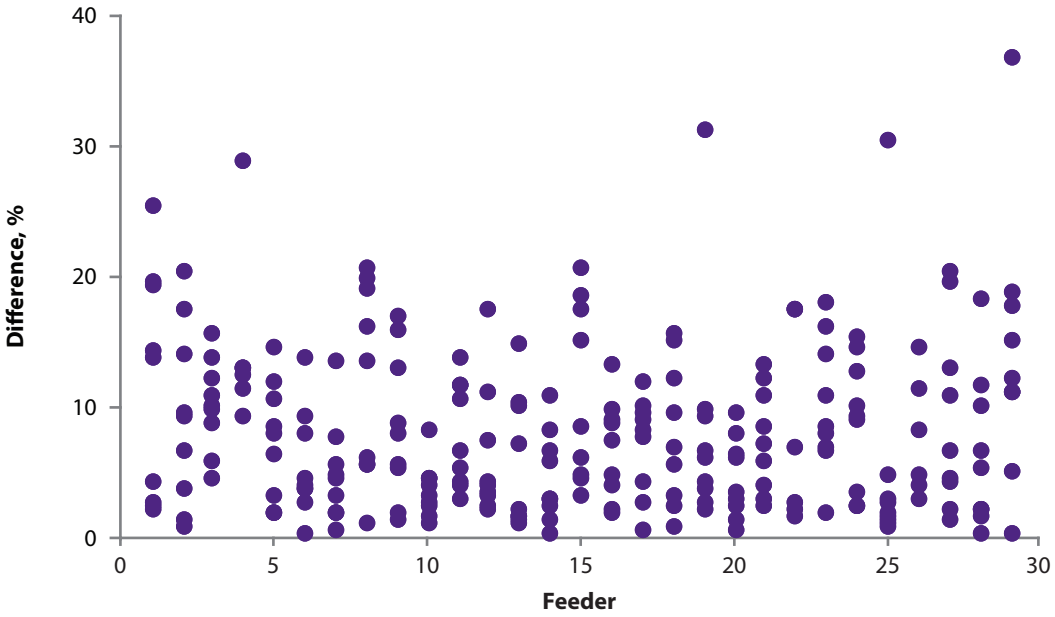

Figure 1. Percentage difference in actual feed dispensed compared to computerized feeder record in Experiment 1. Each point represents a single feed drop collection. There were 3 feed drop collections per lactation period across 3 farrowing groups for a total of 9 observations per feeder. Percentage difference was calculated as the difference between actual- and GESTAL-recorded individual feed drops, expressed as a percentage of actual feed drop weight.

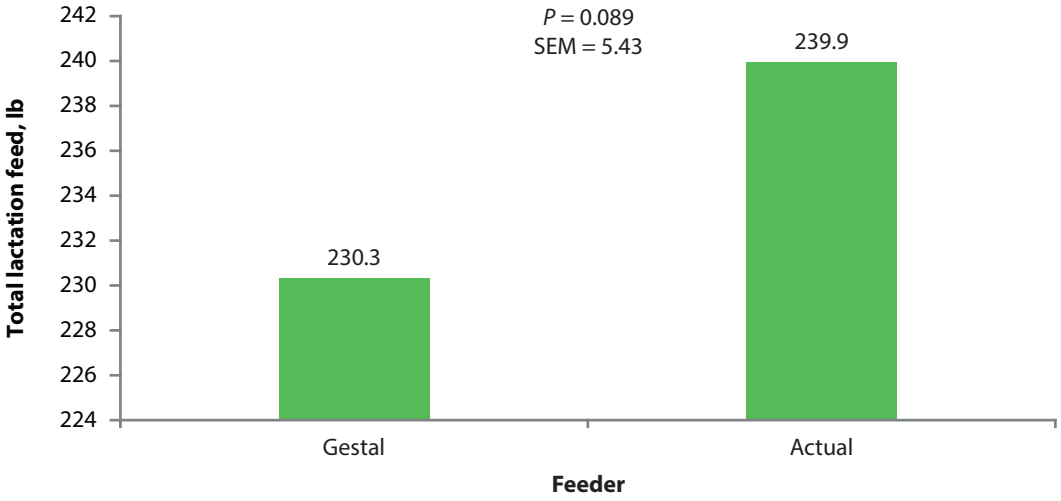

Figure 2. Total recorded feed delivery by GESTAL records and actual measured weight in Experiment 1.

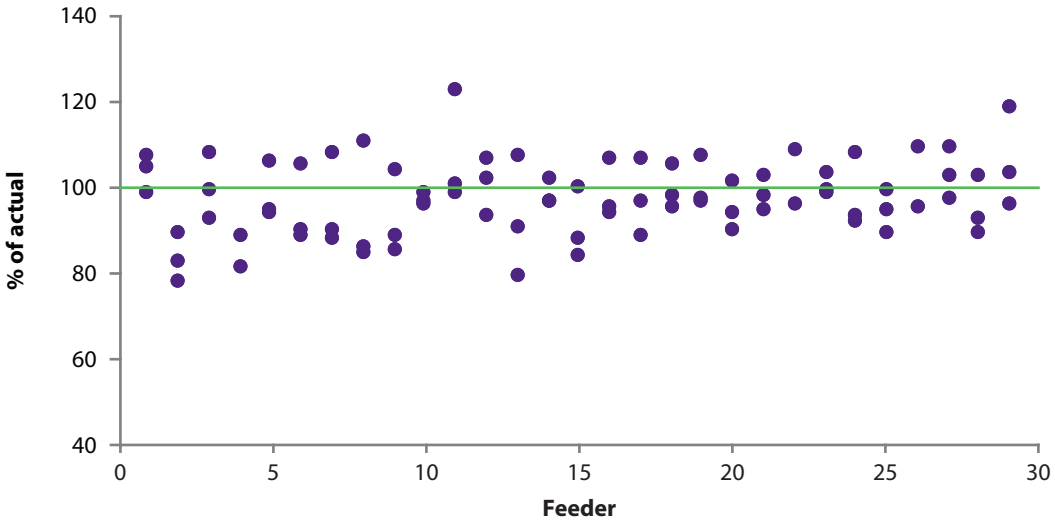

Figure 3. Total computer recorded feed delivery as a percentage of actual in Experiment 1. Each data point represents total feed delivered over each of 3 farrowing groups. Any value greater than 100% shows the computer system recorded more feed than what was actually delivered. Any value less than 100% shows the computer system recorded less feed distributed than what was actually delivered.

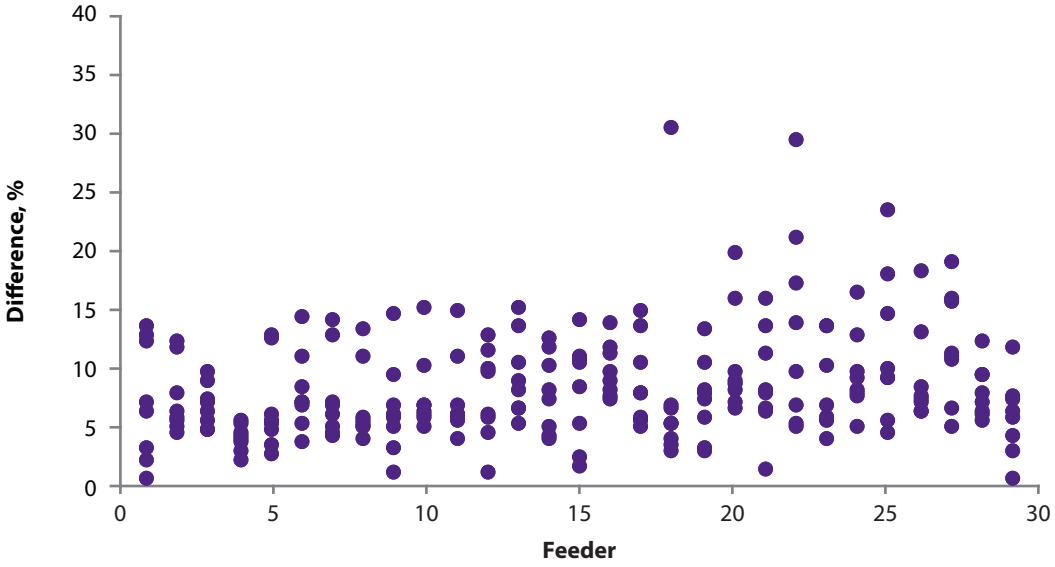

Figure 4. Percentage difference in actual feed dispensed compared to computerized feeder record in Experiment 2. Each point represents a single feed drop collection. There were 8 feed drop collections across 1 farrowing group. Percentage difference was calculated as the difference between actual- and GESTAL-recorded individual feed drops, expressed as a percentage of actual feed drop weight.

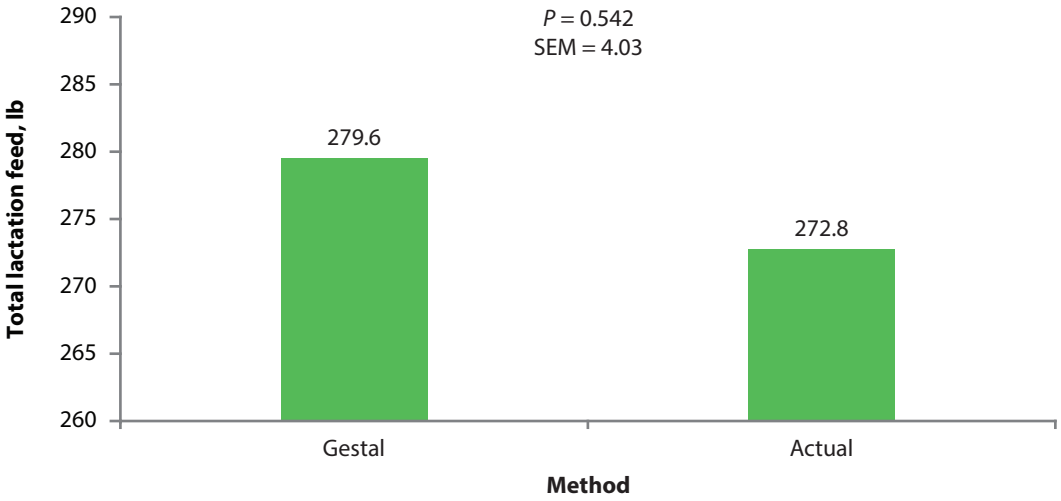

Figure 5. Total recorded feed delivery by GESTAL records and actual measured weight in Experiment 2.

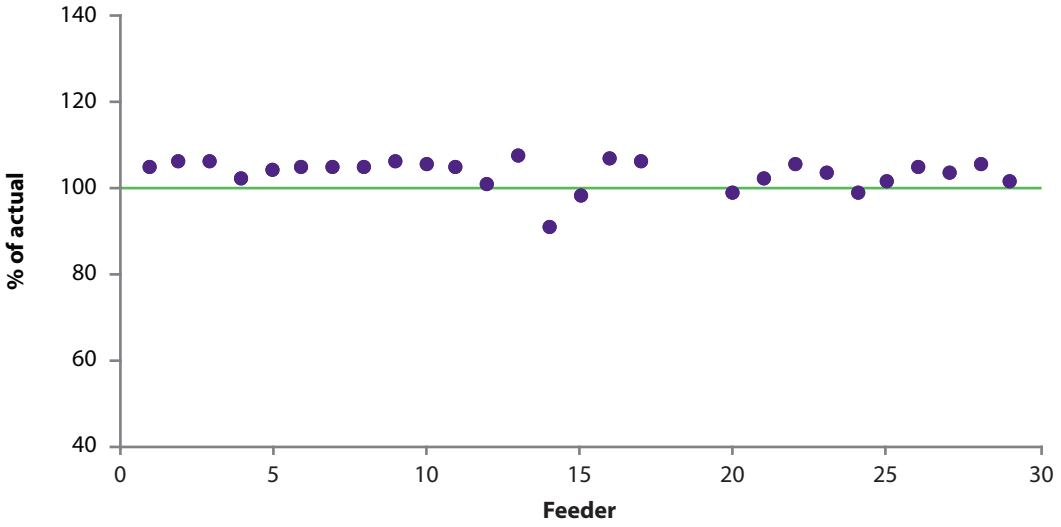

Figure 6. Total computer recorded feed delivery as a percentage of actual in Experiment 2. Each data point represents total feed delivered over each one farrowing group. Any value greater than 100% shows the computer system recorded more feed than what was actually delivered. Any value less than 100% shows the computer system recorded less feed distributed than what was actually delivered.