

2022

Evaluation of In-Barn Feeder Management Prior to Marketing to Reduce Feed Cost, Improve Carcass Yield, and Impact on Economic Return

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Recommended Citation

Cordoba, Hilario M.; DeRouchey, Joel M.; Goodband, Robert D.; Tokach, Mike D.; Woodworth, Jason C.; and Gebhardt, Jordan T. (2022) "Evaluation of In-Barn Feeder Management Prior to Marketing to Reduce Feed Cost, Improve Carcass Yield, and Impact on Economic Return," *Kansas Agricultural Experiment Station Research Reports*: Vol. 8: Iss. 10. <https://doi.org/10.4148/2378-5977.8392>

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Funding Source

Funding, wholly or in part, was provided by the National Pork Board.

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Evaluation of In-Barn Feeder Management Prior to Marketing to Reduce Feed Cost, Improve Carcass Yield, and Impact on Economic Return¹

Hilario M. Cordoba, Joel M. DeRouchey, Robert D. Goodband, Mike D. Tokach, Jason C. Woodworth, and Jordan T. Gebhardt²

Summary

A total of 695 mixed sex growing-finishing pigs (600 × 241, DNA; initially 242.7 ± 1.36 lb) were used in a 14-d trial to determine the effects of feed withdrawal before the first and final marketing event on carcass weight, carcass yield, and economics. Pens of pigs were assigned to 1 of 3 treatments in a randomized complete block design. There were 24 pens per treatment and 9 or 10 pigs per pen. Treatments consisted of none, 6, or 12 h of feeder closure prior to loading pigs on the truck at both the first (2 weeks before final marketing) and final marketing to achieve approximately 12, 18, and 24 h of feed withdrawal prior to harvest at the processing plant. There was no evidence of differences ($P \geq 0.10$) for ADG, ADFI, or F/G during the 14-d period between the first and final marketing event. However, pig BW at time of loadout, with 24-h of feed withdrawal prior to harvest were lighter ($P < 0.05$) than those with only 12 h of feed withdrawal both at first marketing event and the last. Pigs that had access to feed (12 h withdrawal prior to harvest) gained weight during the marketing day, while pigs with 18 or 24 h of feed withdrawal lost weight. For carcass characteristics, pigs at final marketing with 12 h feed withdrawal prior to harvest had increased ($P < 0.05$) HCW compared to those with 24 h feed withdrawal. There was a tendency ($P = 0.055$) for a treatment effect with pigs undergoing 12 h feed withdrawal prior to harvest having a 1.1 lb heavier HCW than those with 24 h feed withdrawal. When evaluating carcass yield, using live weights for all pigs 24 h prior to harvest, pigs in the final marketing group with 12 h of feed withdrawal prior to harvest had greater yield ($P < 0.05$) than those marketed with 24 h of feed withdrawal. However, when evaluating carcass yield using live weights 12 h prior to harvest for the final marketing and overall, pigs marketed at 24 h of feed withdrawal had greater yield ($P < 0.05$) than the other two treatments. Conversely, in the first marketing event, pigs with 12 h of feed withdrawal had decreased yield compared to pigs with the 18 and 24 h of feed withdrawal treatment. There were no differences in backfat, loin depth, and lean % between treatments. Feed consumed on the day of marketing and feed cost per pig were increased ($P < 0.05$) for pigs marketed with 12 or 18 h of feed withdrawal prior to harvest compared to those with 24 h feed with-

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drawal. In conclusion, there were no differences between the treatments on HCW and carcass yield at the first marketing event. However, in the final marketing event, differences were observed between the 12 h feed withdrawal prior to harvest and 24 h feed withdrawal prior to harvest treatments on HCW and carcass yield. Carcass yield was greatest for those with 12 h of feed withdrawal prior to harvest at the final marketing event. Also, as expected, pigs with a longer time of feed withdrawal had reduced feed consumption and feed cost/pig on the day of marketing. Thus, saving in feed cost would have to offset the reduction in carcass weight value to justify withholding feed for greater than 12 h prior to harvest.

Introduction

The finishing pigs inherently experience a period of feed deprivation during transport and lairage. Feed withdrawal before transportation for slaughter reduces feed intake on the day of marketing and thereby reduces feed cost per pig.³ Fasting also reduces gut fill, which ultimately reduces waste at the abattoir.⁴ Frobose et al.⁵ reported no change in hot carcass weight with 16 h of feed removal prior to loadout compared to no removal of feed even though 5.7 lb less feed was consumed on the day of marketing. However, extending feed removal to 24 or 36 h, including a total of 8 h of loading, transportation and lairage, reduced hot carcass weight. These data were based on the last marketing of pigs out of the barn, but to our knowledge no data are available on feed removal for the first group of pigs to be marketed (topped). Current feeder designs utilize quick adjust settings, so feeders could be closed to prevent pigs from eating prior to topping events and then reset after pigs were marketed to supply feed to the remaining pigs in the pen. Thus, these first cut marketed pigs could produce better yield from a short feed removal prior to shipment. While there is concern with out-of-feed events in late finishing, a study⁶ reported no differences in growth performance when finishing pigs had out-of-feed events up to 20 h. The objective of this study was to determine the effects of feed withdrawal prior to marketing on pig performance, carcass traits and economic return over two marketing events.

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in this experiment. This study was conducted at the Kansas State University Swine Teaching and Research Center in Manhattan, KS. The facility was totally enclosed and environmentally regulated, containing 36 pens in each barn. Each pen was equipped with a two-hole dry single-sided feeder (Farmweld, Teutopolis, IL) and a 1-cup waterer. Pigs were stocked at a floor space of approximately 7.0 ft² per pig. Pens were equipped with adjustable gates to allow space allowances per pig to be maintained if a pig died or was removed from a pen during the experiment. Pens were

³ Kephart K.B. and E. W., Mills. 2005. Effect of withholding feed from swine before slaughter on carcass and viscera weights and meat quality. *J Anim. Sci.* Mar;83(3):715-21. doi: 10.2527/2005.833715x.

⁴ Eikelenboom G., A. H. Bolink, W. Sybesma. 1991. Effects of feed withdrawal before delivery on pork quality and carcass yield. *Meat Sci.* 29(1):25-30. doi: 10.1016/0309-1740(91)90020-Q.

⁵ Frobose H. L., S. S. Dritz, M. D. Tokach, K. J. Prusa, J. M. DeRouchey, R. D. Goodband, J. L. Nelssen. 2014. Effects of preslaughter feed withdrawal time on finishing pig carcass, body weight gain, and food safety characteristics in a commercial environment. *J Anim Sci.* 92(8):3693-700. doi: 10.2527/jas.2013-7367.

⁶ Linneen, S.K., S. S. Dritz, R. D. Goodband, M. D. Tokach, J. M. DeRouchey, J. L. Nelssen. 2007. Effects of frequent out-of-feed events on growth performance of nursery and grow-finish pigs. *J. Anim. Sci.* 85:8:2043-2047. doi: 10.2527/jas.2007-0061.

located over a completely slatted concrete floor with a 4-ft pit underneath for manure storage. A robotic feeding system (FeedPro; Feedlogic Corp., Wilmar, MN) was used to deliver and record daily feed additions to each individual pen.

Animals and diets

A total of 695 pigs (600 × 241, DNA; initially 242.7 ± 1.36 lb) were used in a 14-d trial. Pigs were housed in mixed gender pens with 9 or 10 pigs per pen and 24 pens per treatment. Pens of pigs were weighed 5 d prior to the start of the trial and assigned to 1 of 3 treatments in a randomized complete block design with initial weight as a blocking factor. Treatments consisted of none, 6, or 12 h of feeder closure prior to loading pigs on the truck at both the first (2 weeks before final marketing) and final marketing to achieve approximately 12, 18, and 24 h of feed withdrawal prior to harvest at the processing plant. Pigs were loaded out of barns at 8:30 p.m. at each marketing event. Pigs were fed a corn-soybean meal-based diet that was formulated to meet or exceed nutrient requirements for pigs weighing 240 to 280 lb.⁷

Pigs and feeders were weighed at the first and final marketing event at 8:30 a.m. and 8:30 p.m. to determine feed intake and individual BW within the marketing day, and to calculate ADG, ADFI, and F/G using gain and feed intake of the pens between the first and final marketing events. Feeders from treatments with 18 and 24 h of feed withdrawal prior to harvest were closed at 8:30 a.m. and 2:30 p.m., respectively, whereas feeders from the treatment with 12 h of feed withdrawal prior to harvest remained open. On the first marketing event, the 3 heaviest pigs in each pen were selected for marketing. After the first marketing, each pen was adjusted to maintain floor space per pig of approximately 7.0 ft². Pigs also were individually identified with an electronic tag and a tattoo for carcass data collection and transported to a USDA-inspected packing plant (Triumph Foods, St. Joseph, MO) for slaughter at 8:30 a.m. the following day. Carcass measurements included HCW, loin depth, backfat, and percentage lean. Percentage lean was calculated from a plant proprietary equation. Carcass yield was calculated by dividing the pen average HCW by the individual live weight recorded in the morning and in the evening of each marketing event. Gross revenue was calculated by using the HCW calculated using the body weight collected 24 h before slaughter as a covariate, multiplied by a hot carcass price of \$0.90/lb.

Statistical analysis

Data were analyzed as a randomized complete block design for one-way ANOVA using the lmer function from the lme4 package in R (version 4.4.1 (2021-08-10), R Foundation for Statistical Computing, Vienna, Austria) with pen considered as the experimental unit, initial weight as blocking factor, and treatment as a fixed effect. The overall period was calculated from a weighted average of the first and final event values for each analysis. The BW collected 24 h before slaughter was used as covariate for analysis of HCW. Hot carcass weight was used as a covariate for backfat, loin depth, and percentage lean.

⁷ National Research Council. 2012. Nutrient Requirements of Swine: Eleventh Revised Edition. Washington, DC: The National Academies Press. <https://doi.org/10.17226/13298>.

Results and Discussion

For pig BW at time of loadout (12 h before harvest), pigs enrolled on the 24 h of feed withdrawal prior to harvest treatment were lighter ($P < 0.05$) than those on the 12 h withdrawal prior to harvest, both at first marketing and for overall marketing data, but not for the final marketing event (Table 1). This was a result of pigs having different weight gains on each marketing day, with pigs on the 12 h of feed withdrawal prior to harvest treatment having more gain ($P < 0.05$) than both other treatments. Additionally, pigs with 18 h feed withdrawal prior to harvest lost less weight ($P < 0.05$) than pigs with 24 h feed withdrawal prior to harvest when both marketing events were combined. For pig performance during the 14-d period between the first and final marketing event, there was no evidence of differences ($P \geq 0.10$) for any growth criteria between treatments.

For carcass characteristics, pigs at the final marketing event that had 12 h of feed withdrawal prior to harvest had increased ($P < 0.05$) HCW compared to those with 24 h of withdrawal prior to harvest (Table 2). When considering both marketing events, there was a tendency ($P = 0.055$) for a treatment effect with pigs having 12 h feed withdrawal prior to harvest having a 1.1 lb heavier HCW than those with 24 h feed withdrawal prior to harvest. When evaluating carcass yield using live weights for all pigs obtained 24 h prior to harvest, pigs in the final marketing group with 12 h of feed withdrawal before harvest had increased yield ($P < 0.05$) compared to pigs with 24 h of feed withdrawal before harvest. However, when evaluating carcass yield using live weights obtained at load out, 12 h prior to harvest, pigs with 24 h of feed withdrawal prior to harvest had increased yield ($P < 0.05$) compared with the other two treatments at the final marketing event and overall. At the first marketing event, pigs with 24 h of feed withdrawal prior to harvest had increased ($P < 0.05$) carcass yield compared to only the pigs on the 12 h feed withdrawal prior to harvest treatment. There were no differences in backfat, loin depth, and lean percent observed between treatments ($P > 0.10$).

Feed consumed and feed cost per pig on the final marketing and overall event were increased ($P < 0.05$) for pigs marketed with 12 or 18 h of feed withdrawal before harvest compared to those with 24 h feed withdrawal prior to harvest. However, in the first marketing event pigs marketed with 12 h feed withdrawal prior to harvest had increased ($P < 0.05$) feed consumption and feed cost compared to those with 18 h feed withdrawal, with pigs marketed with 24 h feed withdrawal prior to harvest having the lowest ($P < 0.05$) feed consumption and feed cost.

In conclusion, there were no differences between the treatments on HCW and carcass yield at the first marketing event. However, in the final marketing event, differences were observed between the 12 h feed withdrawal prior to harvest and 24 h feed withdrawal prior to harvest treatments on HCW and carcass yield. Carcass yield was affected by time of feed withdrawal prior to harvest with greater yield for pigs with 12 h of feed withdrawal before harvest compared to those with 24 h of feed withdrawal prior to harvest at the final marketing event. Also, as expected, pigs with a longer time of feed withdrawal had reduced feed consumption and feed cost/pig on the day of marketing. Thus, savings in feed cost would have to offset the reduction in carcass weight to justify withholding feed longer than 12 h before harvest on the day of marketing.

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Table 1. Effect of feed withholding prior to harvest on growth performance¹

Item	Feed withdrawal time before harvest ²			SEM	P =
	12 h	18 h	24 h		
BW, lb					
24 h before harvest					
First marketing (d 0)	278.6	276.9	275.0	2.63	0.334
Final marketing (d 14)	280.6	280.4	280.3	2.68	0.994
Overall ³	279.9	279.3	278.7	2.38	0.793
12 h before harvest (at time of loading on the truck)					
First marketing (d 0)	280.8 ^a	275.9 ^{ab}	273.2 ^b	2.42	0.003
Final marketing (d 14)	281.3	280.2	276.6	2.81	0.153
Overall ³	281.1 ^a	278.8 ^{ab}	275.6 ^b	2.44	0.013
BW change, lb/pig ³					
First marketing	2.50 ^a	-1.09 ^b	-1.90 ^b	0.980	< 0.001
Final marketing	0.69 ^a	-0.34 ^a	-3.68 ^b	0.440	< 0.001
Overall ⁴	1.25 ^a	-0.56 ^b	-3.15 ^c	0.490	< 0.001
Overall					
ADG, lb	2.18	2.16	2.10	0.072	0.528
ADFI, lb	6.27	6.27	6.27	0.064	0.997
F/G	2.93	2.95	3.04	0.075	0.307

¹A total of 695 mixed sex pigs (initial BW 242.7 ± 1.36 lb) were used in a 14-d trial with 24 replications per treatment.

²The 3 treatments consisted of none, 6, or 12 h of feeder closure prior to loading on truck at both the first marketing event (2 weeks before final marketing) and final marketing event to achieve approximately 12, 18, and 24 h, respectively, of total feed withdrawal prior to harvest.

³Weighted average from the first and final marketing.

⁴Body weight difference between the 24 h and 12 h before harvest weight records.

Table 2. Effect of feed withholding prior to harvest on carcass characteristics and economics¹

Item	Feed withdrawal time prior to harvest ²			SEM	P =
	12 h	18 h	24 h		
Carcass characteristics					
HCW, lb ³					
First marketing	203.7	203.3	204.2	0.91	0.573
Final marketing	206.3 ^a	205.7 ^{ab}	204.7 ^b	0.38	0.010
Overall ⁴	205.6	205.0	204.5	0.43	0.055
Carcass yield, %					
24 h before harvested					
First marketing	73.8	73.6	73.8	0.30	0.686
Final marketing	73.4 ^a	73.2 ^{ab}	72.9 ^b	0.10	0.010
Overall ⁴	73.5	73.3	73.1	0.20	0.099
12 h before harvested					
First marketing	73.1 ^b	73.8 ^{ab}	74.3 ^a	0.30	0.012
Final marketing	73.2 ^b	73.3 ^b	73.8 ^a	0.10	0.003
Overall ⁴	73.2 ^b	73.5 ^b	73.9 ^a	0.10	< 0.001
Backfat, in. ⁵					
First marketing	0.53	0.52	0.52	0.008	0.572
Final marketing	0.55	0.54	0.56	0.007	0.259
Overall ⁴	0.54	0.54	0.55	0.005	0.449
Loin depth, in. ⁵					
First marketing	2.59	2.60	2.60	0.022	0.945
Final marketing	2.58	2.58	2.55	0.014	0.254
Overall ⁴	2.58	2.59	2.57	0.012	0.492
Lean, % ⁵					
First marketing	56.0	56.1	56.2	0.20	0.703
Final marketing	55.7	55.8	55.5	0.10	0.136
Overall ⁴	55.8	55.9	55.7	0.10	0.372

continued

Table 2. Effect of feed withholding prior to harvest on carcass characteristics and economics¹

Item	Feed withdrawal time prior to harvest ²			SEM	P =
	12 h	18 h	24 h		
Day of marketing feed consumed, lb/pig ⁶					
First marketing	3.43 ^a	1.76 ^b	0.20 ^c	0.212	< 0.001
Final marketing	2.47 ^a	2.63 ^a	0.30 ^b	0.174	< 0.001
Overall ⁴	2.78 ^a	2.36 ^a	0.27 ^b	0.151	< 0.001
Feed cost, \$/pig ⁷					
First marketing	0.43 ^a	0.22 ^b	0.03 ^c	0.026	< 0.001
Final marketing	0.31 ^a	0.33 ^a	0.04 ^b	0.022	< 0.001
Overall ⁴	0.35 ^a	0.29 ^a	0.03 ^b	0.019	< 0.001
Economics					
Gross revenue, \$/pig ⁸					
First marketing	183.3	183.0	183.8	---	---
Final marketing	185.7	185.1	184.2	---	---
Overall ⁴	185.0	184.5	184.1	---	---

¹A total of 695 mixed sex pigs (initial BW 242.7 ± 1.36 lb) were used in a 14-d trial with 24 replications per treatment.

²The 3 treatments consisted of none, 6, or 12 h of feeder closure prior to loading on truck at both the first marketing event (2 weeks before final marketing) and final marketing event to achieve approximately 12, 18, and 24 h, respectively, of total feed deprivation prior to harvested.

³The 24 h BW before harvesting was used as a covariate for analysis of HCW.

⁴Weighted average from the first and final marketing.

⁵The HCW was used as a covariate for analysis of backfat, loin depth, and percentage lean.

⁶Feed used and feed cost was calculated using the feed consumed between the period of 24 h and 12 h before slaughter multiplied by the diet cost per lb.

⁷Diet cost was \$0.125/lb.

⁸Gross revenue = HCW × carcass price. No statistical analysis was conducted.