



BEEF CATTLE RESEARCH UPDATE

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Does Postnatal Metabolic Imprinting Increase Marbling Scores in Fed Cattle?

Several studies have suggested that increasing exposure to high grain (starch) diets to early weaned calves results in greater fat deposition and increased carcass quality at slaughter.^{1,2,3} However, in all of these studies, early weaned calves were placed on high concentrate diets at weaning and remained on these diets until slaughter. A joint research project by Virginia Polytechnic Institute and State University, the University of Minnesota, and the University of Wyoming evaluated the effect of early weaning calves and feeding a high concentrate diet for 148 days before a grazing and feedlot period on feedlot performance and carcass quality.⁴ In this study, fall-born Angus sired steer calves were either normal weaned (NW) at 253 days of age or early weaned (EW) at 105 days of age and fed a high concentrate diet for 148 days. At the time of normal weaning, both treatment groups were combined and grazed on a mixed summer pasture for 156 days. Following this grazing period, all calves were placed in a feedlot and fed a high grain (corn based) diet until slaughter.

At normal weaning age, EW calves were heavier ($P < 0.0001$) than NW calves (752 vs. 585 lb). During the grazing phase, NW steers gained more weight than EW steers (1.54 vs. 0.77 lb/day; $P < 0.0001$). However, EW calves were still heavier on entry into the feedlot (870 vs. 821 lb, $P < 0.0001$). Feedlot performance, backfat thickness, ribeye area, and USDA yield grade were similar between treatments. However, EW steers weighed more at slaughter (1240 vs. 1161 lb; $P < 0.05$) and produced heavier carcasses (736 vs. 683 lb; $P = 0.002$) with higher ($P < 0.001$) marbling scores (645 vs. 518; 400 = Sm⁰, 500 = Md⁰ and 600 = Mt⁰). The distribution of USDA quality grades significantly differed ($P = 0.034$) between treatments. Nearly 42% of the EW calves graded USDA Prime, whereas, none of the NW calves grade Prime. These researchers concluded that early weaning and feeding a high concentrate diet before grazing is a viable strategy to increase carcass weights and marbling deposition as compared with a traditional production system.

Effects of Spoilage of WDGS on Nutrient Composition and Feedlot Performance

The use of wet distiller's grains plus solubles (WDGS) in feedlot diets has increased due the expansion of the ethanol industry. However, WDGS has a high moisture content with 30 to 35% dry matter (DM) which causes storage and shelf-life issues. For this reason, University of Nebraska research evaluated the effects of spoilage of WDGS on the nutrient profile over time and determined the effect on performance and carcass characteristics when feeding spoiled WDGS to growing and finishing cattle.⁵

In experiment 1, a 140-day barrel storage study was conducted to simulate bunker storage. These researchers reported that spoilage caused a loss of DM, organic matter (OM), and neutral detergent fiber (NDF) and that these losses linearly increased as the length of storage time increased. The amount of DM lost because of spoilage increased from 5.0% on day 14 to 21.1% on day 140 ($P < 0.01$). Similarly, the amount of OM lost increased from 4.85% on day 14 to 22.60% on day 140 ($P < 0.01$).

In Experiment 2, steers were fed 1 of 3 treatments during a 130-day finishing experiment: a dry-rolled corn–based control diet and 2 diets containing 40% WDGS replacing dry-rolled corn. The WDGS was purchased from one ethanol plant and split equally within semi-load into either an uncovered bunker (spoiled) or into a silo bag (non-spoiled). Analysis estimated that steers fed the spoiled treatment (WDGS stored in the bunker) consumed WDGS that contained 7% spoilage on average. The calculated loss of DM for WDGS stored in the bunker was 12.3%. In addition, storing WDGS this way resulted in 16% fat, 8% NDF, and 12.3% crude protein being lost (as percentage of initial amounts). No differences in feedlot performance ($P \geq 0.26$) were observed between WDGS treatments. However, both WDGS treatments led to improved daily gains, final weights, and feed efficiency ($P \leq 0.04$) compared to cattle fed the dry-rolled corn control diet.

In Experiment 3, steers were fed 1 of 4 treatments in an 84-d growing experiment: spoiled (stored in bunker) versus non-spoiled (stored in silo bag) WDGS fed at 15 or 40% of the diet (DM basis). Steers receiving the spoiled treatments consumed WDGS that contained 7% spoilage on average, which was similar to the amount being fed in Experiment 2. The calculated loss of DM for WDGS stored in the bunker was 6%. It was noted the lower DM loss in this experiment as compared to experiment 2 (6 vs 12.3%) could have been caused by seasonal differences because this WDGS was stored throughout the winter as compared to the summer months in Experiment 2. Cattle fed spoiled WDGS consumed 8.6% less DM than cattle fed non-spoiled WDGS (16.32 vs. 17.86 lb, $P < 0.01$). However, over time differences in intake, numerically, became minimal, suggesting that the cattle were adapting to the spoiled WDGS. Daily gain (0.93 vs. 1.00 lb/day), final weights (810 vs. 816 lb), and gain efficiency (0.054 vs. 0.054 lb gain/lb feed) were similar for steers fed spoiled vs non-spoiled WDGS. Steers fed 40% WDGS consumed more feed and gained faster and more efficiently than steers fed 15% WDGS.

These researchers concluded that that the spoilage process that occurs when WDGS is stored in a bunker causes a loss of DM and nutrients, with decreases in percentage of fat. However, feeding WDGS that contains some spoilage (7%) did not affect finishing cattle performance. Feeding WDGS that contained 7% spoilage to growing steers did decrease feed intake but had little effect on ADG and no effect on gain efficiency.

¹ Myers, S. E., D. B. Faulkner, F. A. Ireland, L. L. Berger, and D. F. Parrett. 1999. Production systems comparing early weaned to normal weaning with or without creep feeding for beef steers. *J. Anim. Sci.* 77:300-310.

² Meyer, D. L., M. S. Kerley, E. L. Walker, D. H. Keisler, V. L. Pierce, T. B. Schmidt, C. A. Stahl, M. L. Linville, and E. P. Berg. 2005. Growth rate, body composition, and meat tenderness in early vs. traditionally weaned beef calves. *J. Anim. Sci.* 83:2752-2761.

³ Schoonmaker, J. P., F. L. Fluharty, S. C. Loerch, T. B. Turner, S. J. Moeller, and D. M. Wulf. 2001. Effect of weaning status and implant regimen on growth, performance, and carcass characteristics of steers. *J. Anim. Sci.* 79:1074-1084.

⁴ Scheffler, J. M., M. A. McCann, S. P. Greiner, H. Jiang, M. D. Hanigan, G. A. Bridges, S. L. Lake, and D. E. Gerrard. 2014. Early metabolic imprinting events increase marbling scores in fed cattle. *J. Anim. Sci.* 92:320-324.

⁵ Harding, J. L., K. M. Rolfe, C. J. Schneider, B. L. Nuttelman, D. B. Burken, W. A. Griffin, A. L. Shreck, G. E. Erickson, and T. J. Klopfenstein. 2014. Effects of spoilage of wet distillers grains plus solubles when stored in a bunker on nutrient composition and performance of growing and finishing cattle. *Prof. Anim. Sci.* 30:225-234.

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