



BEEF CATTLE RESEARCH UPDATE

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Effect of Postweaning Diet on Fertility in Replacement Beef Heifers

Management of beef replacement heifers from weaning to breeding is critical to their lifetime productivity. Historically, replacement heifers have been fed a diet to achieve 60 to 65% of mature body weight (BW) by breeding at 14 months of age.¹ This practice was based on research conducted during the late 1960s through the early 1980s. However, research conducted over the last 10 years has found that feeding beef heifers to 50 to 55% of mature BW reduced body size and development costs without compromising pregnancy rate. Recently published research from the U.S. Meat Animal Research Center in Clay Center, NE determined whether developing pre-pubertal heifers on less dietary energy and to a BW of 55% rather than 65% of mature BW at 14 months of age would compromise ovarian development and reduce fertility.²

These researchers used 8 month old Angus (60 hd/yr) and MARC II (stable composite of 1/4 Angus, 1/4 Hereford, 1/4 Simmental, and 1/4 Gelbvieh; 60 hd/yr) heifers in a study replicated over three years (2009, 2010, and 2011). In each year, heifers receive either a low or high BW gain diet fed to achieve an average daily gain (ADG) of either ~1.0 or 1.75 lb/day from 8 to 15 month of age, including the first 21 days of the breeding period, and then transferred to pasture. At 14 months of age, the heifers were exposed to bulls for 47 days. The low-gain diet consisted of 30% corn silage and 70% alfalfa haylage (13% crude protein and 61.6% TDN) and the high-gain diet consisted of 69% corn silage and 31% high-moisture corn (11.8% crude protein and 74.4% TDN).

Average daily gain during the treatment period was 1.74 lb/day for the high-gain heifers compared with 1.04 lb/day for the low-gain heifers ($P \leq 0.01$). The high-gain heifers were 16% heavier ($P \leq 0.01$) than the low-gain heifers at the onset of the breeding period (926 vs. 798 lb) and 12% heavier at the end of the 47-day breeding period (921 vs. 824 lb; $P \leq 0.01$). In 2010 and 2011, 97.2% of heifers were cycling by 21 days of breeding. Post-weaning ovarian development was not compromised by treatment. It was noted that a greater proportion of the high-gain compared with the low-gain heifers conceived within the first 21 days of the breeding period (64.4 vs. 49.2%; $P < 0.01$), but overall pregnancy rate was not affected by treatment (83.0 vs. 77.7%, respectively; $P > 0.10$).

These authors concluded that the results from this study agree with previous studies indicating that development of replacement beef heifers on less energy and at a smaller ADG from 8 months of age to achieve 55% of their mature BW at breeding may enable producers to reduce associated feed costs without compromising ovarian development and the proportion of heifers becoming pregnant during a 45-day breeding period. However, they noted that the smaller proportion of low-gain heifers becoming pregnant within the first 21 day of the breeding period may compromise their stayability in the herd as a result of calving and breeding later in subsequent years, especially if a greater restriction in BW gain was imposed during the post-weaning period.

Effect of Diet Fed to Beef Cows before Calving on Feedlot Performance and Carcass Characteristics of Progeny

Recent Ohio State University research used 228 mature Angus crossbred cows to investigate the effects of maternal prepartum dietary energy source on progeny growth and carcass composition in a two year study.³ In this study, beginning at approximately 160 days of gestation, cows were fed diets consisting of 1 of 3 primary energy sources: ad libitum grass hay, limit-fed corn (high-starch concentration), or limit-fed dried corn distillers grains with solubles (DDGS; high fiber, protein, and fat concentrations). The corn and DDGS diets were limit-fed to achieve similar energy intakes as

cows fed hay. The cows were removed from these diets one week before expected calving date, fed a common diet of grass hay until calving, and then managed on pasture as a single group until weaning. Calves were weaned at an average of 185 days of age and backgrounded for 28 days. A group of the progeny (134 head) was individually fed a common finishing diet until slaughter at a targeted backfat thickness of 0.47 inches (based on ultrasound).

These researchers reported that calf birth weights were greater ($P = 0.002$) in calves from cows fed corn (91.9 lb) and DDGS (90.4 lb) than calves from cows fed hay (84.9 lb). At weaning, calves from cows fed corn were heavier ($P = 0.08$; 539 lb) than calves from cows fed hay (519 lb) and calves from cows fed DDGS were intermediate (523 lb). Feedlot performance (gains, intake, feed efficiency, and final body weight) did not differ among treatments. In addition, hot carcass weight, backfat thickness, ribeye area, and USDA yield grade did not differ among treatments. However, marbling scores ($P = 0.03$) were greater in carcasses from calves whose dams were fed a low-starch diet (hay and DDGS) vs. a high-starch diet (corn), resulting in a different ($P = 0.005$) distribution of carcasses grading USDA Select (0, 6.4, and 16.3% for progeny from cows fed hay, DDGS, and corn, respectively). The USDA quality grade distribution did not differ ($P \geq 0.32$) among treatments for USDA Low Choice, Upper 2/3 Choice, and Prime.

In summary, these authors concluded that these results indicate that prepartum maternal dietary energy source can alter fetal growth and fetal adipose tissue development, affecting birth weight, and resulting in long-term effects on progeny's intramuscular (marbling) fat deposition. Feeding a diet low in starch (hay or DDGS) vs. one high in starch (corn) in late gestation was associated with greater marbling deposition in progeny when measured at a constant backfat fat thickness. In contrast, several research studies have suggested that increasing exposure to high grain (starch) diets to early weaned calves results in greater marbling deposition and increased carcass quality at slaughter.^{4,5,6} These differing results appear to suggest that energy composition of a maternal diet could have a different effect on fetal adipose tissue development than energy composition of diets fed after birth. Thus, these researchers concluded that additional research is needed to determine which mechanisms alter fetal growth and development in late gestation and affect resulting adipose tissue development and fat deposition during postnatal growth and development.

¹ Funston, R. N., J. L. Martin, D. M. Larson, and A. J. Roberts. 2012. PHYSIOLOGY AND ENDOCRINOLOGY SYMPOSIUM: Nutritional aspects of developing replacement heifers. *J. Anim. Sci.* 90:1166-1171.

² Eborn, D. R., R. A. Cushman, and S. E. Echtenkamp. 2013. Effect of postweaning diet on ovarian development and fertility in replacement beef heifers. *J. Anim. Sci.* 91:4168-4179.

³ Radunz, A. E., F. L. Fluharty, A. E. Relling, T. L. Felix, L. M. Shoup, H. N. Zerby, and S. C. Loerch. 2012. Prepartum dietary energy source fed to beef cows: II. Effects on progeny postnatal growth, glucose tolerance, and carcass composition. *J. Anim. Sci.* 90:4962-4974.

⁴ Schoonmaker, J. P., M. J. Cecava, F. L. Fluharty, H. N. Zerby, and S. C. Loerch. 2004. Effect of source and amount of energy and rate of growth in the growing phase on performance and carcass characteristics of early- and normal-weaned steers. *J. Anim. Sci.* 82: 273-282.

⁵ 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.

⁶ Shike, D. W., D. B. Faulkner, M. J. Cecava, D. F. Parrett, and F. A. Ireland. 2007. Effects of weaning age, creep feeding, and type of creep on steer performance, carcass traits, and economics. *Prof. Anim. Sci.* 23:325-332.