Evaluation of the effects of pre-breeding beef heifer management on mid to late gestation uteroplacental hemodynamics

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In a well-managed beef herd, heifers should represent the most valuable genetics in the herd and be an improvement over the previous generation of females. Recent economic conditions have brought forth a trend in which heifers are developed in “low input” management scenarios where they typically achieve 50-55% (as opposed to the more traditional 65-70%) of projected mature body weight at breeding. The uterine environment during gestation is known to have lifelong epigenetic effects on offspring. This is often achieved by imposing suboptimal conditions or nutrition prior to breeding or during gestation, and the effects may be translated to the developing calf by altered patterns of uteroplacental blood flow. Thus, it was hypothesized that low input heifer development protocols resulting in lightweight heifers at breeding may cause decreased uteroplacental blood flow during pregnancy compared to traditionally developed females, even when nutrition during gestation is equivalent. Therefore, the objective of the present study was to evaluate the effects of heifer development practices on uteroplacental hemodynamics during mid- to late-gestation of nulliparous beef females. To this end, crossbred beef heifers (n=15) developed on either a low input (LOW; n=6) or a conventional (CON; n=9) heifer development scheme were bred at 15 months of age. All heifers were comingled and managed on a forage based management program. Body weight (BW) was assessed every 30 d, and Doppler ultrasonography was used to assess blood flow metrics of uterine arteries on d 180, 210, and 240 of gestation. Arterial diameter (AD), blood flow (BF), resistance index (RI), and pulsatility index (PI) were evaluated for uterine arteries contralateral and ipsilateral to the conceptus, and total blood flow (TBF) was calculated as the sum of blood flow from both. Variables were analyzed using the MIXED procedure of SAS for Windows 9.3. Heifers in the LOW group had decreased BW throughout gestation (p=0.0003). Uterine RI and PI were not different across treatment or day. Measures of uterine BF were not different across treatment. As expected, a main effect of day was observed for BF, whereby contralateral, ipsilateral, and TBF increased as gestation progressed (p=0.0001, 0.0041, 0.0003, respectively). However, when adjusted for BW, an additional main effect of treatment was observed (p=0.0079) in which LOW heifers had increased TBF as compared to CON heifers. Correspondingly, an interaction between treatment and gestational day was observed for AD of both contralateral and ipsilateral uterine arteries (p=0.0236 and 0.0087 respectively), whereby AD increased as gestation progressed, and LOW heifers displayed increased AD. It was concluded that developing replacement heifers with low input management schemes does not yield compromised uteroplacental hemodynamics as compared to traditionally developed females when nutrition during gestation is adequate.

Keywords: Uterine blood flow, Doppler ultrasonography, fetal programming, heifer development