Pre-breeding beef heifer management and season affect mid to late gestation uteroplacental hemodynamics

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Introduction

In a well-managed beef herd, heifers should represent the most valuable genetics in the herd and be an improvement on 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% of projected mature body weight at breeding as opposed to the more traditional 65-70%. Seasonal differences in calf performance and heifer reproductive efficiency have also been observed. 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 light weight heifers at breeding may cause decreased uteroplacental blood flow during pregnancy compared to traditionally developed females even when nutrition during gestation is equivalent. Furthermore, it was posited that calving season may also alter uteroplacental hemodynamics. Therefore, the objective of the present study was to evaluate the effects of heifer development practices and season on uteroplacental hemodynamics during mid to late gestation of nulliparous beef females.

Materials and Methods

Fall calving and spring calving crossbred beef heifers (n = 27) developed on either a low input (LOW | FALL n = 6) (LOW | SPRING n = 6) or a conventional (CON | FALL n = 9) (CON | SPRING n = 6) heifer development scheme were bred at 15 months of age. After confirmation of pregnancy, heifers were comingled and managed on a forage based management program. Body weight (BW) was assessed every 30 days, and Doppler ultrasonography was used to assess blood flow metrics of uterine arteries on day 180, 210, and 240 of gestation. Arterial diameter (AD) and blood flow (BF) 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. All data are presented as mean ± SEM.

Results

There were significant treatment*season (P = 0.0001) and season*day (P = 0.0028) interactions on heifer BW. On day 180 of gestation LOW | FALL, LOW | SPRING, CON | FALL, and CON | SPRING heifers weighed 832±22, 793±28, 989±20, and 1130±21 pounds, respectively. Main effects of season (P = 0.0358) and gestational day (P = 0.0001) were observed on contralateral BF, and there was a season*day interaction (P = 0.0274) on ipsilateral BF. As such, there was a season*day interaction on TBF (P = 0.0494) whereby TBF increased as gestation progressed and spring calving heifers displayed increased TBF. However, when adjusted for BW, an additional main effect of treatment was observed (P = 0.0007) in which LOW heifers had increased TBF compared to CON heifers. Correspondingly, there was a main effect of day (P = 0.0001) and a treatment*season interaction (P = 0.0225) on contralateral AD. Furthermore, there was a main effect of treatment (P = 0.0248) and a season*day interaction (P = 0.0484) on ipsilateral AD in which AD increased as gestation progressed. LOW heifers displayed increased AD compared to CON heifers, and spring calving heifers had greater AD than fall calving females.

Significance

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. Furthermore, spring calving two year old heifers have increased uteroplacental blood flow compared to their fall calving counterparts.