Effects of maternal bypass protein supplementation during early gestation on subsequent progeny performance in beef cattle

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Abstract

Protein supplementation during late gestation has been shown to be beneficial to fetal development. However, little is known about early gestation protein supplementation when supplements contain high or low amounts of ruminally undegraded protein (RUP). Therefore, a two-year study was conducted using 28 mixed-aged cows that consumed a basal diet balanced to meet nutrient requirements for early gestation were randomly assigned to receive one of three treatments during the first trimester of pregnancy, 1) no supplement (CON; n = 10); 2) 38% CP supplement containing 36% RUP (LRUP; n = 9); 3) 38% protein supplemented containing 50% RUP (HRUP; n = 9). All cows were managed similarly after the completion of the supplementation period. There were no treatment × year interactions observed for any variable measured. Subsequent progeny birth and weaning BW did not differ between treatments ($P \geq 0.08$). Calf weaning weight was greater in year 1 compared to year 2 ($P < 0.001$). After weaning, calves were placed in an individual feeding system for a 60 d feeding period. Body weight was recorded biweekly and intake was measured daily. Intake from day 0 to 14 and 14 to 28 tended to be greater ($P \leq 0.07$) for HRUP and LRUP when compared to unsupplemented control. Nonetheless, ADG and gain:feed was similar for all treatments ($P \geq 0.21$). Steers were transitioned to a finishing diet and harvested at approximately 18 mo of age. No differences were observed in ribeye area, hot carcass weight, or yield grade ($P \geq 0.23$). Overall, under the conditions of this study, supplementing cows during the first trimester with a high protein supplement that varied in ruminally undegradable protein did not impact progeny growth or carcass characteristics.

Introduction

- Calf development and productivity is crucial to a successful cattle operation.
- A healthy, viable calf is ideal for a profitable market in producing a sustainable protein source for the ever growing population (Oltjen and Beckett, 1996).
- Improper nutrition during pregnancy can have long-term effects on subsequent progeny in humans, which is termed fetal programming (Barker et al., 1993)
- Fetal programming is any alteration to the dam whether it be genetic, environmental, or dietetic that has a direct effect on progeny performance and survival (Funston et al., 2010).
- The internal organs of the fetus are the most sensitive to changes in the dam's diet in early gestation with organogenesis occurring rapidly in that developmental time frame (Meyer et al., 2010).
- In previous studies, ruminally undegradable protein supplementation during late gestation has been shown to positively affect progeny body weight, feed efficiency, and reproductive success (Funston et al., 2010).
- There is little research conducted on early gestation supplementation in beef cattle.

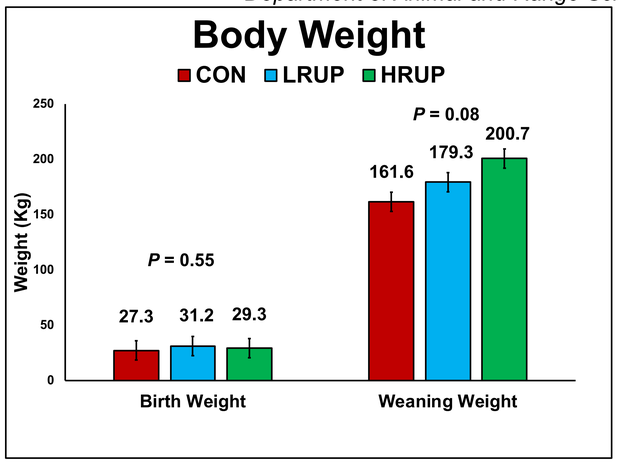
Hypothesis

Maternal supplementation of high levels of ruminally undegradable protein during early pregnancy will positively effect feed efficiency and growth of progeny.

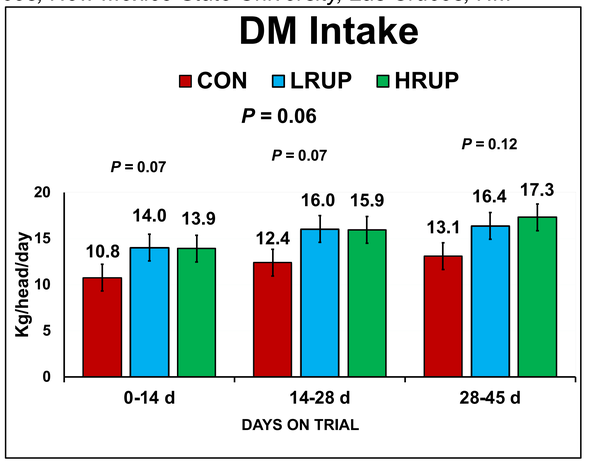
Objectives

To determine the growth characteristics of progeny born to dams supplemented either high or low levels of ruminally undegradable protein during early gestation

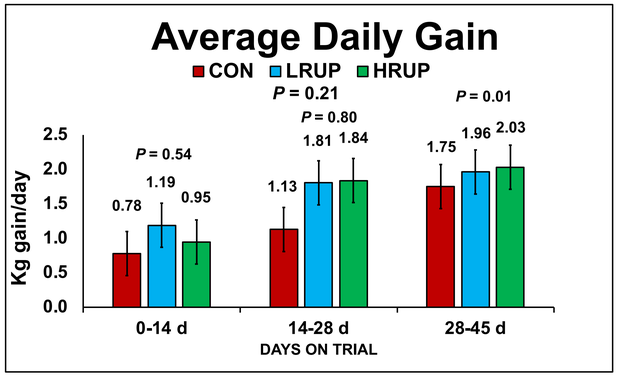
Body Weight



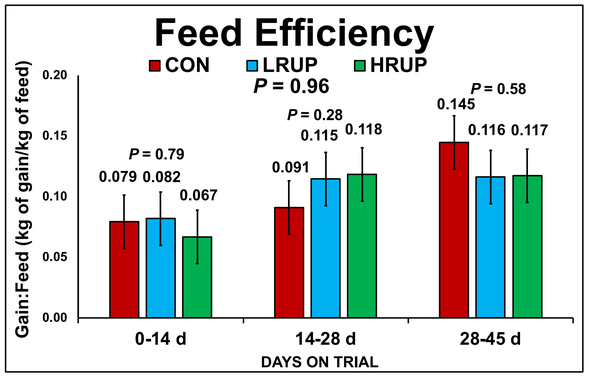
DM Intake



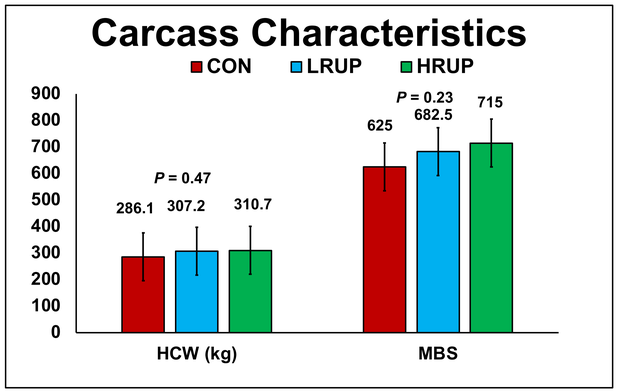
Average Daily Gain



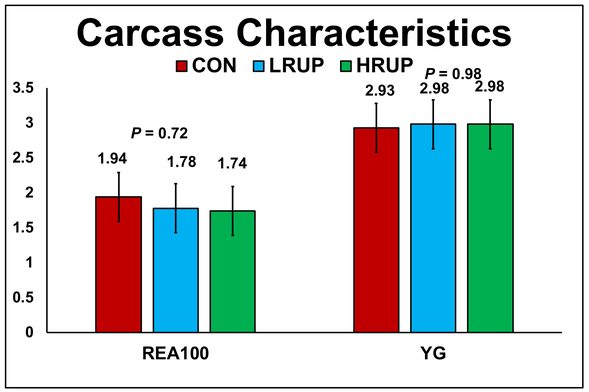
Feed Efficiency



Carcass Characteristics



Carcass Characteristics



Materials and Methods

All procedures were conducted in accordance with an approved NMSU Institutional Animal and Care Committee protocol

- 15 cows were randomly assigned to one of three treatments fed during early gestation
- CON: Received a diet to meet or exceed nutrient requirements
- LRUP: Animals were fed CON diet plus a protein supplement with low levels of ruminally undegradable protein supplement during early gestation
- HRUP: animals were fed CON diet plus a protein supplement with high levels of ruminally undegradable protein supplement during early gestation
- Subsequent progeny were weaned and at approximately 10 months of age were individually fed a common diet in the Broadbent Calan gate system
- Calves were fed ad libitum a ration that was 10.4% CP DM, 74.98% TDN DM, and 31.7% NDF DM.
- Calves were weighed bi-weekly and serum was collected.
- At the conclusion of the feeding period, steers were finished at the New Mexico State University Campus Education and Research Center and then harvested at the University of Arizona Food Product and Safety Lab.
- Data was analyzed as a completely randomized design using Mixed Procedure in SAS.

Results

- Weaning weight tended to be greater ($P = 0.08$) in supplemented treatments compared to the control.
- Dry matter intake tended to be greater ($P = 0.06$) for progeny from dams fed supplemental protein during early gestation.
- Average daily gain did not differ across treatments (P = 0.21), but a numeric difference was observed that coincided with greater dry matter intake
- Feed efficiency did not differ amongst treatments ($P = 0.96$)
- Carcass traits, hot carcass weight, marbling score, ribeye area, and yield grade, did not differ across treatments.

Conclusions

We conclude that despite dietary intake increasing in progeny from dams fed supplemental ruminally undegradable protein during early gestation, growth performance was not impacted. Weaning weights of calves in treated groups showed promise of being greater when dams were supplemented. Future research is needed to determine if differences in intake would remain as animals grew with age and how supplementation impacts other production parameters such as reproduction.