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Calf Note #161 – Nutrition during gestation affects growth of calves

Introduction

There's an old saying "what goes around, comes around". While this saying seems increasingly appropriate for newborn calves. More research in cattle and other species of animals suggests that what happens to the mother during gestation will have long-lasting effects on newborns after birth. In some cases, these effects may be observed much later in life.

Calf Note #152 discusses the effects of prepartum nutrition and management on IgG absorption in newborn calves. Additional research suggests that prepartum energy restriction can affect growth and body composition of calves later in life. In this Calf Note, we'll look at the results of three studies that suggest that what happens during gestation can affect the calf's later growth and development.

The research

The first study was conducted at the University of Wyoming (Long et al., 2011). Cross-bred beef cattle were bred artificially and 45 days thereafter, pregnancy was confirmed and the cows were placed into groups – Control (fed at 100% of NRC recommendations), Restricted (fed at 70% of the Control cattle) and R+AA (fed at 70% of NRC but had amino acids to provide the same level of protein/amino acids as Control cattle). Cows were fed their experimental diets until 185 days of gestation. Thereafter, cows were grouped together and fed the control diet.

Calves born in each group were fed and managed as one group along with their dams until weaning at 214 d and then were backgrounded for 28 d. After birth, calves were raised normally – bull calves were castrated at 2 months of age; weaned at 210 d; and backgrounded for 28 days prior to entering the feedlot for 195 days. Calves were slaughtered and carcass characteristics were determined.

At the end of the experimental period, cows fed the restricted diets without additional amino acids were about 40 kg lighter than control cows and had lower body condition score. Cows fed restricted diet with added amino acids were lighter than control cows, but the difference was not statistically significant.

There was no effect of maternal nutrition on calf BW at birth (average 36, 39, and 41 kg for Control, Restricted + AA and Restricted treatments, respectively) or at slaughter. However, the body composition of calves was affected by the diet of their dams during gestation. Calves fed the Restricted diet (without added AA) had higher yield grades (3.42 vs. 3.01 and 3.03 for Restricted, Control and Restricted + AA, respectively). Beef carcasses are graded numerically on a 1 to 5 scale with 1 being highest quality and 5 lowest quality. More information on how yield grades are

determined is available here. Thus, a score of 3.4 would be lower quality compared to a yield grade of 3.0.

In addition, the composition of fat in Restricted calves had increased adipocyte (fat cell) size and composition. Differences in adipocyte composition suggest that the metabolism of calves had changed and calves from nutrient Restricted cows had different metabolism of fat cells. Perhaps this altered metabolism was responsible, in part, for lower carcass quality.

This study suggested that when the dam receives improper nutrition, the metabolism of the newborn can be affected – even much later in life. This interesting study may have important implications to newborn dairy calves, also.

Effects of maternal nutrition on calf growth was evaluated in a second study conducted in Nebraska with grazing beef cattle (Martin et al., 2007). In this 3-year study, cows were fed 0 or 1 lb (0.45 kg/d) of a protein supplement while grazing during late gestation.

Birth statistics (dates, size) of the 170 heifer calves born from supplemented and unsupplemented cows were similar (calves weighed 36 kg at birth). However, BW at 205-days were higher in calves born from dams that received protein supplement (226 vs. 218 kg). Heifers from supplemented cows were also heavier at time of pregnancy diagnosis (400 vs. 386 kg). Also, more of these heifers became pregnant (93%) compared to heifers born from dams that were unsupplemented (80%).

Late gestation nutrient restriction of the mother appeared to have a profound effect on performance of calves – even manifested later in life.

Finally, a study was reported by Laporte-Broux et al. (2011) using dairy goats. Dams were fed control diets (100% of NRC recommendations) or Restricted diets (50-70% of nutrient intake of Control) during the last third of gestation. Restricted goats lost 8% of their BW during the experimental period compared to a loss of 1.3% of BW for Control goats.

Kids born to the Restricted goats were lighter and had smaller abdominal girth than kids born to Control goats. In addition, male kids in the Restricted group used fatty acids differently than other kids, suggesting an alteration in nutrient metabolism due to maternal diet. However, other tests of behavior and metabolism indicated little long-term effect of maternal nutrient restriction. The researchers evaluated behavioral and metabolic parameters, but few varied between treatments.

The results of this study should be evaluated in context. Newborn kids from Restricted goats were smaller and had higher concentrations of fatty acids in their blood. Clearly, their metabolism differed from kids born from dams on the Control diet. It's possible that kids were not evaluated long enough to see the long-term effects of nutrient deprivation on metabolism. For example, in the Wyoming study, changes in body composition were determined only at slaughter. On the other hand, it's possible that nutrient deprivation during the final trimester of gestation may have less of an effect than earlier nutrient deprivation. However, since most fetal BW is deposited during the

final trimester, it's unlikely that nutrient deprivation during this critical time in the development of the fetus wouldn't have an effect.

Implications

Take care of your heifers and cows. What you do to them, you'll do to the calves they're carrying. These research studies indicate clearly that the diet of the mother may affect the size and/or future productivity of the offspring. So, if your normal dry cow nutrition program is unimproved pasture or unlimited straw unbalanced for other nutrients, you may be putting your calves at risk.

Effects of maternal nutrient deprivation can be long term and may affect calf growth, health, reproduction and body composition later in life. Although these studies didn't evaluate effects of prepartum nutrition in dairy cattle, there is increasing evidence across species that what you do to your cows will affect your calves.

References

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