The impact of prepartum energy intake on colostrum quality and calf performanc

HOW DOES THE ENERGY INTAKE OF THE DAM AFFECT COLOSTRUM QUALITY AND CALF PERFORMANCE?

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Background: It is becoming well-recognized that dam nutritional status during gestation, particularly in the second and third trimesters, can have a significant impact on not only reproductive efficiency, but also calf health and performance. A previous ABP-supported project discovered that oversupplying protein to beef cows in late gestation improved nitrogen retention, total tract digestibility, rumen fermentation, but also decreased colostrum fat concentration and altered expression for some muscle and growth related genes in the calves.

However, energy is often the most limiting nutrient in beef cow diets as nutrient requirements are significantly increased due to gestation and lactation. Previous research has noted that fat stores are broken down by beef cattle in early lactation, which means current nutritional models may be underestimating nutritional requirements in this phase. In addition, dam nutrition in late gestation contributes to the nutritional and biologically active compounds that are available to create colostrum. In dairy cattle, some of these biologically active compounds have been shown to impact calf metabolism, stimulate calf intestinal development, and act as local antimicrobials within the digestive tract; however, very little work has examined these aspects of colostrum in beef cattle. Colostrum macronutrient composition may also be affected by the dam diet during gestation, which could impact calf health and performance.

Objectives: The objectives of this study are to determine how different dietary energy intakes during gestation impact:

1. Cow body weight gain and energy reserves pre- and post-calving
2. Blood metabolites and hormones that indicate energy balance
3. Colostrum production and composition
4. Late gestation glucose tolerance and insulin sensitivity
5. Pre-weaning calf growth and metabolism

What they did: 152 pregnant crossbred cows (107 mature, 45 first-calvers) were fed diets formulated to meet either 80%, 100% or 120% of predicted metabolizable energy (ME) requirements for approximately 50 days prior to calving. Diets also met or exceeded protein requirements. Cow body weight, rib and rump fat depth, body condition score, colostrum and blood samples were collected at multiple time points pre- and post-calving, and again at weaning. Intravenous glucose tests were performed on a subset of both heifers and cows about a week prior to calving. Calf measurements included body weight and frame size, as well as blood samples at various time points until 55 days of age and again at weaning.

What they learned: Not surprisingly, cows fed 120% and 100% of ME requirements lost less body weight, rump, and rib fat than the cows fed 80%. There were no differences in body weight, rib, or rump fat post-

calving. Also not surprisingly, this effect was greater for first-calf heifers.

Pre-calving cows fed 120% of ME requirements had higher serum glucose levels, while those fed 80% of ME requirements had higher serum non-esterified fatty acids and urea, indicating increased fat and muscle breakdown. These differences disappeared after calving. Moreover, this effect was greater for first-calf heifers as compared to mature cows.

There were no differences in calf birth weight, body weight and frame measurements to 55 days of age, average daily gain, or weaning weight between the maternal diets, but calves from mature cows outperformed those from first-calf heifers regardless of diet. There were also no differences in instances of calving difficulty, passive immunity transfer (as measured by calf serum IgG), calf morbidity or mortality. However, during the first two days of life, calves from dams fed 80% of ME requirements had higher serum urea.

Colostrum yield was greatest for cows fed 120% of ME requirements (2.55 kg vs. 1.45 kg), and mature cows produced more total colostrum than first-calf heifers (2.74 kg vs 1.44 kg). Due to the higher total yield, colostrum from the cows on the high energy diet had greater grams of crude fat (187 g), crude protein (469 g), lactose (23 g), urea (1 g), and IgG (370 g), as well as higher gross energy (4.2 Mcal). However, when colostrum constituents were expressed on a percentage or grams per litre basis, the cows on the lowest energy diet had the highest percentages due to the overall lower volume of colostrum produced.

What it Means: Providing increased feed energy during late gestation improved energy balance (reducing the fat and protein body reserves used for energy) and increased colostrum production, but these effects did not persist after calving. Overall, calf performance was not significantly affected by different levels of dam energy intake. While there were definite energy balance and colostrum differences between the cows on the high energy diet and the low energy diet, the differences between the cows fed 120% of ME requirements versus those fed 100% of ME requirements was not substantive. This means that the critical component for improved cow energy balance and optimal colostrum production is ensuring that cow energy requirements are met during late gestation, and supports the importance of feed testing and developing balanced rations.

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