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Impacts of Bovine Maternal Nutrition on Mirna Expression in Skeletal Muscle of the Progeny during Growth

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Objectives

Decreased gestational nutrition has been shown to alter deposition of adipose tissue in the offspring within several different livestock species. Currently, little is known pertaining to the cellular mechanism(s) that are responsible for these observed changes in adipose deposition and skeletal muscle growth. This study investigated whether progeny from cows with restricted nutrition during the second trimester had different expression of microRNA known to be involved in either skeletal muscle or adipose deposition in the skeletal muscle during growth when compared to progeny from non-restricted cows.

Materials and Methods

Cows were all bred by the same Angus sire, stratified by body weight (P = 0.80) and body condition score (BCS; P = 0.72) and allocated to 1 of 2 different treatment groups: maintenance (n = 16) or restricted (n = 18). Restricted cows (REST) were provided with lower forage biomass (1662 kg/ha, dry matter) in comparison with maintenance (MAINT; 2309 kg/ha, DM). Restricted cows had a mean BCS 1.55 lower (P = 0.001) than MAINT at the end of the period and a weight difference of 188 Kg (P = 0.024). After the second trimester all cows and their subsequent calves were treated similarly. At the beginning of the feedlot stage skeletal muscle biopsies were collected from the offspring from the *biceps femoris* (BF) and immediately snap frozen in liquid nitrogen. Additionally, samples were collected from the offspring from the *longissimus lumborum* (LD) within 20 min of harvest and snap frozen in liquid nitrogen. Expression of miR-1, –133a/b, –206, –181d, –27b, –424, –486, –214, and let-7 g was analyzed using quantitative real-time PCR methods.

Results

Offspring from REST cows expressed more (P < 0.05) MiR-133a, –133b, –206, –214, –424 and –486 in the BF at the beginning of the feedlot phase when compared to offspring from MAINT cows. There was no difference ($P \geq 0.12$) in expression of Mir-1, –27b, or –181d in the BF between the 2 treatment groups at this phase of growth. Furthermore, at harvest, offspring from REST cows expressed more ($P < 0.05$) MiR-133a and –486 in the LD than offspring from MAINT cows. Offspring from REST cows also have a tendency (P = 0.09) for increased expression of MiR-133b in the LD when compared to offspring from MAINT cows. No differences ($P \geq 0.44$) in expression of MiR-1, –27b, –181d, –206, –214, –424, or –486 were detected in the LD immediately following harvest between offspring from either the REST or MAINT cows.

Conclusion

These data provide novel insight into alterations in microRNA expression in the skeletal muscle during growth from offspring born from cows with restricted nutrient intake in the second trimester. Offspring born from REST cows expressed more MiRNA involved in both adipose and skeletal muscle growth which is likely involved in the cellular mechanism(s) that ultimately determine meat quality through their effects on skeletal muscle growth and adipose deposition. However, further research needs to be completed to determine the exact role that these microRNA have in skeletal muscle growth and adipose deposition.