Nutrient supply alters adipose tissue physiology in pre-weaned calves

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Early life nutrient supply in calves can affect their performance as future dairy cows and adipose tissue is likely to be a key part of that process as it is involved in the regulation of energetic, reproductive and immunological processes. However, it is not clear how early life nutrition alters the molecular regulation of adipose tissue in calves and potentially adult individuals. This study aimed at determining how differences in pre-weaning nutrient supply alter gene expression profiles in fat tissue. A total of 12 female Holstein calves were fed two levels of milk replacer supply: a restricted amount of 11.72 MJ ME intake per day (RES, n=6) or an enhanced amount of 1.26 MJ ME intake per kg of metabolic body weight. All calves had ad libitum access to a commercial calf starter (22% CP) and water. Treatments lasted for 54 ± 2 days, when calves were slaughtered and adipose tissue was collected for transcriptome analysis through microarray. A total of 396 genes were differentially expressed (DE) between groups with an average fold change of 2. IPA analysis revealed that DE genes were involved in 9 categories of molecular and cellular functions, including Cell Cycle (57 genes) and Lipid Metabolism (63 genes). The directional expression (up or down-regulation) of 26 Lipid Metabolism genes indicated that Fatty Acid Metabolism was increased while the expression direction of 30 and 23 Cell Cycle genes indicated that Interphase and Mitosis processes respectively were increased in adipose tissue of calves offered an enhanced nutrient supply.

Implications: Adipose tissue of calves under an enhanced nutrient supply not only experiences an increased development rate (hyperplasia) but also a higher metabolic activity through increased fatty acid metabolism. Future studies are necessary to explore whether early life changes in adipose tissue regulation can be imprinted and lead to improved adult life performance of dairy cows.