Maternal High Protein Diet Changes the Expression of Growth and Development Related miRNAs in Fetal Skeletal Muscle

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Abstract: Maternal nutrition during pregnancy is critical to the growth and development of the fetus while microRNAs (miRNAs) are regulating the genes involved in growth and development. However, the underlying mechanisms of miRNA modulation in growing fetus through maternal nutritional input is poorly understood. Furthermore, the effects of maternal high protein diet on the global expression of miRNAs has not been investigated yet, either in animals or human. This study was conducted to examine the effects of maternal high protein diet on the expression of miRNAs in fetal skeletal muscle. Twelve ewes, with similar age and body score, were grouped into two groups, 6 ewes in each group. One group was fed standard protein diet (SPD, 83-116 g/day) while the other group was fed high protein diet (HPD, 182-270 g/day) during the pregnancy. The fetal skeletal muscle was collected on day 105th of the pregnancy and the expression of miRNAs was evaluated using Affymetrix GeneChip® miRNA 4.0 Array which contains 30424 mature miRNAs from all organisms. The results showed that a total of 11 miRNAs including miR-3957-5p, miR-432, miR-200c, miR-362, and miR-409-3p were differentially regulated (DR). Surprisingly, all the DR miRNAs showed upregulation trend in HPD compared to SPD. Target prediction and pathway analysis showed that several pathways related to growth and development were affected by the genes predicted to be targeted by the DR miRNAs. Our result showed that maternal high protein diet could influence the abundance of miRNAs that could potentially affect different pathways related to growth and development.

Keywords: Maternal nutrition, High protein diet, Skeletal muscle, MicroRNA