Abstract

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Maternal vitamin D deficiency causes smaller muscle fibers and altered transcript levels of genes involved in protein degradation, myogenesis, and cytoskeleton organization in the newborn rat.

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SCOPE: Epidemiologic data reveal associations between low serum concentrations of 25-hydroxyvitamin D (25(OH)D) and higher risk of falls and muscle weakness. Fetal stage is critical for the development of skeletal muscle, but little information is available on the impact of maternal vitamin D deficiency on muscles of offspring.

METHODS AND RESULTS: To investigate the morphology and transcriptome of gastrocnemius muscle in newborns in response to maternal vitamin D deficiency, 14 female rats were fed either a vitamin D3 deficient (0 IU/kg) or a vitamin D3 adequate diet (1000 IU/kg) 8 weeks prior to conception, during pregnancy, and lactation. Analysis of cholecalciferol, 25(OH)D3 and 1,25-dihydroxyvitamin D3 show that dams fed the vitamin D deficient diet and their newborns suffered from a relevant vitamin D deficiency. Muscle cells of vitamin D deficient newborns were smaller than those of vitamin D adequate newborns (p < 0.05). Muscle transcriptome of the newborns revealed 426 probe sets as differentially expressed (259 upregulated, 167 downregulated) in response to vitamin D deficiency (fold change ≥1.5, p < 0.05). The effected genes are involved in protein catabolism, cell differentiation and proliferation, muscle cell development, and cytoskeleton organization.

CONCLUSION: Maternal vitamin D deficiency has a major impact on morphology and gene expression profile of skeletal muscle in newborns.

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