

The Effect of High-fat diet on Vascular Smooth Muscle Cell Mechanics and Migration in ApoE^{-/-} Mice

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Atherosclerosis remains a leading cause of cardiovascular diseases, which cause causes about 30% of global death. Vascular smooth muscle cells (VSMCs) are the major cellular components of arterial wall. VSMCs play critical role in the atherosclerosis development by phenotypic switching from a contractile phenotype to a synthetic phenotype, migration from media to intima of arterial wall, and deposition as foam cells in atherosclerotic plaque. In this study, we tested the effect of high-fat diet on the VSMC mechanics by comparing the mechanics and migration of VSMCs isolated from apolipoprotein-E knockout (ApoE^{-/-}) and wild type (WT) mice. Atomic force microscope (AFM) was employed to test cell adhesion and stiffness of VSMCs. AFM was also used to examine live VSMC submembranous cytoskeleton organization. A data-driven mathematical models-based image and signal processing software was used to analyze AFM data. Two-way ANOVA was used to test statistical significance for all experiments. The results demonstrated significant differences in the actin cytoskeletal organization and cell mechanics between ApoE^{-/-} VSMCs and WT cells upon high-fat diet. However, no significant difference in cell stiffness was observed between normal diet-fed ApoE^{-/-} and WT VSMCs. These interesting findings on the effect of high-fat diet on VSMC mechanics will improve our knowledge of the mechanism underlying the contribution of VSMC in the development of atherosclerosis.