Effects of glucose and alpha-tocopherol on low-density lipoprotein oxidation and glycation

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Abstract

Glycation of blood proteins is considered to be a major contributor to hyperglycemic complications in diabetes mellitus patients. In this study, we demonstrate the efficacy of alpha-tocopherol in reducing low-density lipoprotein (LDL) oxidation and glycation in vitro. Native LDL isolated from healthy subjects was exposed to various concentrations of glucose and malondialdehyde (MDA) with or without alpha-tocopherol enrichment for 7 days in sealed vacuum ampoules. The degree of glycation, copper-induced lag time, content of thiobarbituric acid-reactive substances (TBARS), and alpha-tocopherol levels in LDL were then assessed. LDL lag time was significantly reduced with high levels of glucose and MDA. Alpha-tocopherol enrichment dramatically inhibited the oxidation of LDL in the lag-time assay. However, the length of incubation time was inversely related to the LDL lag time. Longer incubation time resulted in shorter LDL lag time, with or without alpha-tocopherol enrichment. The level of TBARS associated with LDL oxidation was highest in native, MDA-supplemented, and high-glucose samples. The alpha-tocopherol levels were inversely related to glucose levels and incubation times. In conclusion, high-glucose concentrations heightened the oxidative susceptibility of LDL. Alpha-tocopherol enrichment reduced this trend and prevented LDL from undergoing architectural modification.