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# Ginger extract consumption reduces plasma cholesterol, inhibits LDL oxidation and attenuates development of atherosclerosis in atherosclerotic, apolipoprotein E-deficient mice.

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## Abstract

Oxidative modification of LDL is thought to play a key role in the pathogenesis of atherosclerosis. Consumption of nutrients rich in phenolic antioxidants has been shown to be associated with attenuation of development of atherosclerosis. This study was undertaken to investigate the ex vivo effect of standardized ginger extract on the development of atherosclerosis in apolipoprotein E-deficient (E(0)) mice, in relation to plasma cholesterol levels and the resistance of their LDL to oxidation and aggregation. E(0) mice (n = 60; 6-wk-old) were divided into three groups of 20 and fed for 10 wk via their drinking water with the following: group i) placebo (control group), 1.1 % alcohol and water (11 ml of alcohol in 1 L of water); group ii) 25 microg of ginger extracUd in 1.1 % alcohol and water and group iii) 250 microg of ginger extracUday in 1.1 % alcohol and water. Aortic atherosclerotic lesion areas were reduced 44% (P<0.01) in mice that consumed 250 microg of ginger extracUday. Consumption of 250 microg of ginger extracUday resulted in reductions (P<0.01) in plasma triglycerides and cholesterol (by 27 and 29%, respectively), in VLDL (by 36 and 53%, respectively) and in LDL (by 58 and 33%, respectively). These results were associated with a 76% reduction in cellular cholesterol biosynthesis rate in peritoneal macrophages derived from the E(0) mice that consumed the high dose of ginger extract for 10 wk (P<0.01 ). Furthermore, peritoneal macrophages harvested from E(0) mice after consumption of 25 or 250 microg of ginger extracUday had a lower (P<0.01) capacity to oxidize LDL (by 45 and by 60%, respectively), and to take up and degrade oxidized LDL (by 43 and 47%, respectively). Consumption of 250 microg of ginger extracUday also reduced (P<0.01) the basal level of LDL-associated lipid peroxides by 62%. In parallel, a 33% inhibition (P<0.01) in LDL aggregation (induced by vortexing) was obtained in mice fed ginger extract. We conclude that dietary consumption of ginger extract by E(0) mice significantly attenuates the development of atherosclerotic lesions. This antiatherogenic effect is associated with a significant reduction in plasma and LDL cholesterol levels and a significant reduction in the LDL basal oxidative state, as well as their susceptibility to oxidation and aggregation.

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