The two faces of α- and γ-tocopherols: an in vitro and ex vivo investigation into VLDL, LDL and HDL oxidation.

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BACKGROUND: Vitamin E and its derivatives, namely, the tocopherols, are known antioxidants, and numerous clinical trials have investigated their role in preventing cardiovascular disease; however, evidence to date remains inconclusive. Much of the in vitro research has focused on tocopherol's effects during low-density lipoprotein (LDL) oxidation, with little attention being paid to very LDL (VLDL) and high-density lipoprotein (HDL). Also, it is now becoming apparent that γ-tocopherol may potentially be more beneficial in relation to cardiovascular health.

OBJECTIVES: Do α- and γ-tocopherols become incorporated into VLDL, LDL and HDL and influence their oxidation potential in an in vitro and ex vivo situation?

DESIGN: Following (i) an in vitro investigation, where plasma was preincubated with increasing concentrations of either α- or γ-tocopherol and (ii) an in vivo 4-week placebo-controlled intervention with α- or γ-tocopherol. Tocopherol incorporation into VLDL, LDL and HDL was measured via high-pressure liquid chromatography, followed by an assessment of their oxidation potential by monitoring conjugated diene formation.

RESULTS: In vitro: Both tocopherols became incorporated into VLDL, LDL and HDL, which protected VLDL and LDL against oxidation. However and surprisingly, the incorporation into HDL demonstrated pro-oxidant properties. Ex vivo: Both tocopherols were incorporated into all three lipoproteins, protecting VLDL and LDL against oxidation; however, they enhanced the oxidation of HDL.

CONCLUSIONS: These results suggest that α- and γ-tocopherols display conflicting oxidant activities dependent on the lipoprotein being oxidized. Their pro-oxidant activity toward HDL may go some way to explain why supplementation studies with vitamin E have not been able to display cardioprotective effects.

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