Coenzyme Q10 in plasma and erythrocytes: comparison of antioxidant levels in healthy probands after oral supplementation and in patients suffering from sickle cell anemia.

Niklowitz P, Menke T, Wiesel T, Mayatepek E, Zschocke J, Okun JG, Andler W. Vestische Kinderklinik Datteln, University Witten-Herdecke, Dr.-Friedrich-Steiner-Str. 5, D-45711 Datteln, Germany.

BACKGROUND: The membrane-associated antioxidant coenzyme Q10 (CoQ10) or ubiquinone-10 is frequently measured in serum or plasma. However, little is known about the total contents or redox status of CoQ10 in blood cells.

METHODS: We have developed a method for determination of CoQ10 in erythrocytes. Total CoQ10 in erythrocytes was compared to the amounts of ubiquinone-10 and ubihydroquinone-10 in plasma using high-pressure liquid chromatography (HPLC) with electrochemical detection and internal standardisation (ubiquinone-9, ubihydroquinone-9).

RESULTS: Investigations in 10 healthy probands showed that oral intake of CoQ10 (3 mg/kg/day) led to a short-term (after 5 h, 1.57 +/- 0.55 pmol/microl plasma) and long-term (after 14 days, 4.00 +/- 1.88 pmol/microl plasma, p<0.05 vs. 1 h, 1.11 +/- 0.24 pmol/microl plasma) increase in plasma concentrations while decreasing the redox status of CoQ10 (after 14 days, 5.37 +/- 1.31% in plasma, p<0.05 vs. 1 h, 6.74 +/- 0.86% in plasma). However, in these healthy probands, CoQ10 content in red blood cells remained unchanged despite excessive supplementation. In addition, plasma and erythrocyte concentrations of CoQ10 were measured in five patients suffering from sickle cell anemia, a genetic anemia characterised by an overall accelerated production of reactive oxygen species. While these patients showed normal or decreased plasma levels of CoQ10 with a shifting of the redox state in favour of the oxidised part (10.8-27.2% in plasma), the erythrocyte concentrations of CoQ10 were dramatically elevated (280-1,093 pmol/10^9 ERY vs. 22.20 +/- 6.17 pmol/10^9 ERY).

CONCLUSIONS: We conclude that normal red blood cells may regulate their CoQ10 content independently from environmental supplementation, but dramatic changes may be expected under pathological conditions.

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