REVIEW ARTICLE

The Instability of the Lipid-Soluble Antioxidant Ubiquinol: Part 2–Dog Studies

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Abstract

Background: Coenzyme Q10 is one of the most widely sold nutritional supplements in the United States. Coenzyme Q10 is available in both its oxidized form (ubiquinone) and its reduced form (ubiquinol). The predominant marketing of Coenzyme Q10 to physicians and patients asserts that the ubiquinol form of Coenzyme Q10 has superior absorption to the ubiquinone form. This study has been designed to compare and contrast the stability and absorption of ubiquinol supplements, as well as the claims made for ubiquinol compared with ubiquinone.

Ubiquinol, the reduced state of Coenzyme Q10, is commercially available as a nutritional supplement; however, ubiquinol, by its nature as an electron donor, is much less stable than ubiquinone, the oxidized state of Coenzyme Q10. The absorption, bioavailability and efficacy of ubiquinol products has been much less often tested in clinical trials. Consequently, insufficiently documented marketing claims are being made for ubiquinol supplements.

Methods: In Part 1 of this report on the instability of the lipid-soluble antioxidant ubiquinol, SIBR Research presented data from lab studies showing that oral ubiquinol is likely to be oxidized to ubiquinone and absorbed as ubiquinone. In this Part 2, SIBR Research conducted a study of the transfer and absorption of orally ingested ubiquinol in large dogs.

Results: In the dog studies, the percentage of ubiquinol converted to ubiquinone increased as the capsule contents passed through the stomach and small intestines and into the lymph system.

Conclusions: The dog studies demonstrate that oral ubiquinol in commercial nutritional supplements is not stable in the gastrointestinal tract of large dogs. Based on these results, it seems likely that in humans also, most of the ubiquinol from capsules will be oxidized to ubiquinone in the acid profile between the stomach and the small intestines, where there is a wide range of acidity. The ubiquinol from the supplement will be absorbed in the ubiquinone state and will pass into the lymph system as ubiquinone, where it will be reduced back to ubiquinol. It will pass from the lymph system into the blood circulation as ubiquinol.

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Introduction

Ubiquinone (fully oxidized state) and ubiquinol (fully reduced state) are the major states of the lipid-soluble vitamin-like bionutrient known as Coenzyme Q10 (CoQ10). There is also a transient intermediate state, ubisemiquinone (also known as semiquinone) that has multiple unexplained biologic functions.[1]

In American usage, the terms CoQ10 and CoQH2 are commonly used for ubiquinone and ubiquinol, respectively. In European usage, the designations Q10 and QH2 are more commonly used.

Both the ubiquinone state and the ubiquinol state are bioactive redox forms of Coenzyme Q10. Ubiquinone plays an essential role in the production of cellular ATP energy. Ubiquinol plays an important role as a lipid-soluble antioxidant. As such, ubiquinol helps prevent the peroxidation of the LDL lipoproteins in the blood.[2]

It is misleading to claim that ubiquinol is more important than ubiquinone.[2] Both states of Coenzyme Q10 are important. That ubiquinol is the predominant form of Coenzyme Q10 in the blood makes sense in that there is relatively little need for the bioenergetics form (ubiquinone) in the circulation while there is a manifest need for the antioxidant form (ubiquinol).[2]

When Coenzyme Q10 in the blood passes into the tissues, there are numerous enzyme systems available to to maintain adequate levels of ubiquinol. Mantle and Dybring list 5 enzyme systems that facilitate this conversion: NAD(P)H dehydrogenase quinone 1 (known as NQO1),