Comparative Bioavailability of Coenzyme Q_{10} in Four Formulations

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Coenzyme Q10 (CoQ10) plays an essential role in mitochondrial electron transport, and as such it is fundamental for energy production in cells.[1] Further, CoQ10 is an antioxidant whose activity is particularly important in regenerating vitamin E. Its ability to quench free-radicals also helps maintain the structural integrity and stability of mitochondrial and cellular membranes—including intracellular membranes.[2] Studies have shown therapeutic benefits for CoQ10 supplementation, the best documented of which involve cases of heart failure and ischemic heart disease.[3]

Because CoQ10 is a lipid-soluble nutrient, its bioavailability from pharmaceutical and nutritional products can be limited. USANA uses a patented solubilization system in its current CoQuinone product, which is highly effective in promoting high CoQ10 absorption. However, many of the solubilizing ingredients are synthetic, and ideally an all-natural formula would be preferable. This study was designed to compare the bioavailability of CoQ10 as delivered by four formulas, including a new, proprietary, all-natural formula developed by USANA scientists.

Methods

This prospective crossover study involved 14 healthy subjects. Four coenzyme Q10 formulations were prepared: a dry tablet without cyclodextrins, a dry tablet containing a preformed cyclodextrin-CoQ10 complex, the current USANA CoQuinone liquid formula in a soft-gel capsule, and USANA's new proprietary liquid formula in a hard gelatin capsule. Given the crossover design, each subject participated in each of the four treatments in serial fashion, with a washout period (six days) between treatments.

On the morning of the first test, subjects reported to the laboratory for a baseline blood draw. After the blood draw, each participant was given a CoQ10 supplement with a standard meal. Additional blood samples were then drawn at 3, 5, and 8 hours after supplementation. This protocol, beginning with a baseline blood draw, was repeated three more times as the subjects rotated through the four treatments.

All blood samples were processed, and plasma fractions were analyzed for CoQ10 via HPLC with an electrochemical detector. Increases from baseline in plasma CoQ10 concentrations were calculated, and statistical comparisons between treatments were run. In addition, increases in plasma CoQ10 were plotted as a function of time following supplementation, and area under the curve (AUC) was calculated as an indicator of bioavailability over

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time. Statistical comparisons were also made for these AUCs.

Results

The four formulas showed dramatic differences in CoQ10 bioavailability (Figures 1 and 2). The dry tablet formula without cyclodextrins gave only marginal increases in plasma CoQ10 over baseline levels. The dry tablet formula with cyclodextrins appeared to be slightly better, but again, increases over baseline were modest.

The two liquid formulas, however, produced significant rises in plasma CoQ10. A 100 mg dose of CoQ10 delivered in USANA's current CoQuinone formula boosted plasma levels of this coenzyme to about 225% of baseline levels at five hours after supplementation. Levels declined by eight hours. USANA's new proprietary liquid formula gave similar results. Plasma CoQ10 concentrations rose to over 200% of baseline by five hours after supplementation, but then retained these elevated levels through eight hours (Figure 1). Comparisons of AUCs further highlight the differences between treatments (Figure 2).

Importantly, USANA's current CoQuinone formula and the new proprietary, all-natural formula gave virtually identical results with respect to this time-integrated measure of CoQ10 bioavailability.

Discussion

This study was undertaken as part of a program to develop a new CoQ10 formula with high bioavailability comparable to the current CoQuinone product, but without using synthetic solubilizers. Two new formulas were tested. The first, a dry tablet formula, contained CoQ10 complexed with cyclodextrins (ring-shaped starch polymers used to promote the solubility and bioavailability of fat-soluble active ingredients[4]). The second was an all-natural liquid formula based on lecithin, medium chain triglycerides, and glycerine monooleate.

The dry tablet formula with cylcodextrins did not provide the high levels of bioavailability necessary to meet USANA's standards. The new all-natural liquid formula did. Results showed that time courses were similar for normalized plasma CoQ10 levels following supplementation with either USANA's current CoQuinone formula or the new all-natural liquid formula. Furthermore, these two formulas performed identically when results were subjected to a time-integrated AUC measure of bioavailability.

We conclude that USANA's new liquid CoQ10 formula, comprising all natural ingredients, delivers the same high level of CoQ10 bioavailability as the company's current CoQuinone formula.

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Figure 1

Increase from baseline in plasma CoQ10 concentrations following supplementation with 100mg of CoQ10 (as delivered by four different formulas).

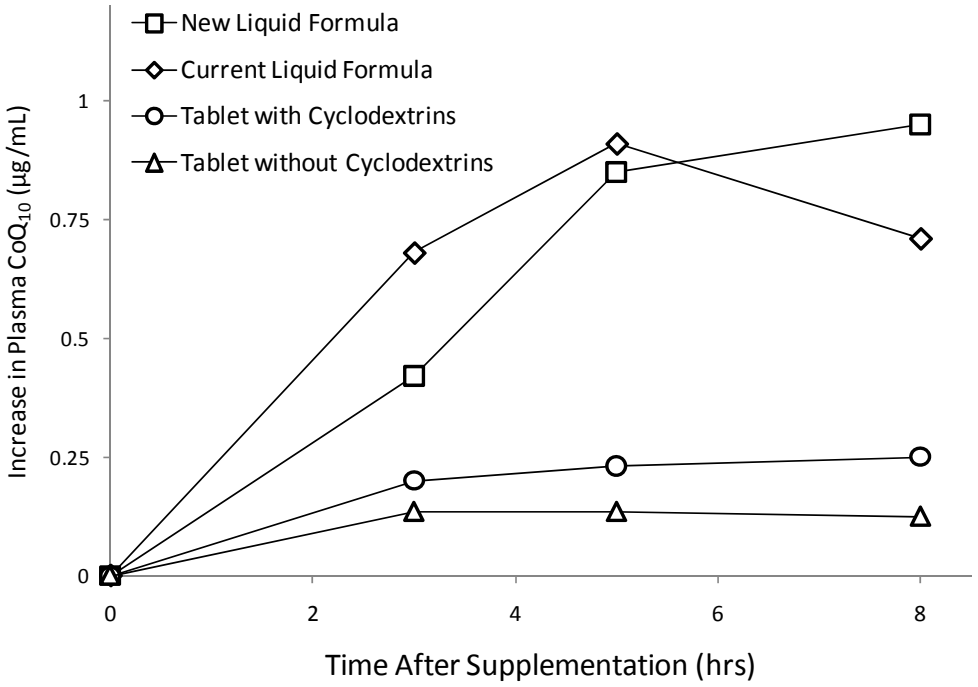
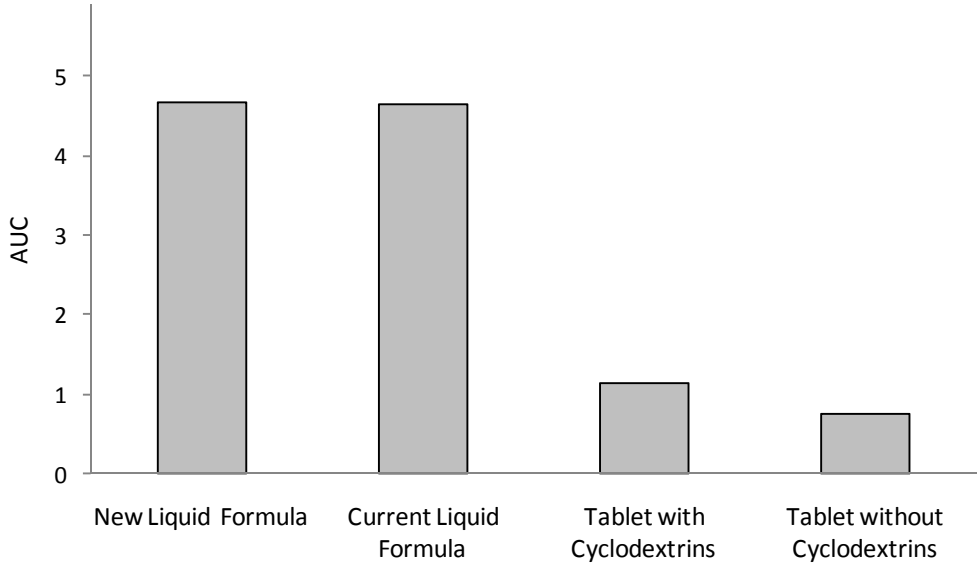


Figure 2

Comparison of area under the curve (AUC) for the eight-hour plasma CoQ10 response curves shown in Figure 1.



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