Ubiquinone Increases Performance of an Elderly Runner: A Case Report

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Abstract

Manufacturers of Coenzyme Q10 present different reports in marketing Ubiquinol or Ubiquinone. Each one suggests that their product is more favorable for resolving compromised health issues or poor energy metabolism associated with aging. This case study reports the running performance of a 71-year male runner while taking Ubiquinol, or Ubiquinone, each for 90-days, or taking neither supplement following a 14-day washout period. The subject’s best performance time on the same course while taking Ubiquinone was 2.28% faster than his time on the same course after a 14-day washout period without supplement dose. The subject’s best performance time on the same course while taking Ubiquinol was –1.16% slower than his time on the same course after a 14-day washout period without supplement dose. The results from a single-subject Case Report are definitively inconclusive, and thus call for more research by collecting dose-aided and dose-fasted timed performances from a larger contingent of male and female runners of all ages.

Introduction

Coenzyme Q-10 (Ubiquinol or Ubiquinone) may enhance health quality and improve energy production with benefits for endurance and exercise performance. Supplement forms of CoQ10 are manufactured as Ubiquinol and Ubiquinone. Manufacturers present differing views to consumers for taking Ubiquinol or Ubiquinone:

UBIQUINOL
1. Ubiquinol is more absorbable (delivered by oil suspension) than conventional Ubiquinone in every clinical trial to date.
2. Ubiquinol conversion decreases with age or compromised health.
3. Ubiquinol is the predominant form (over 90%) of CoQ10 in healthy humans.

UBIQUINONE
1. Ubiquinone is absorbed at same rate as ubiquinol (over-double powdered ubiquinone in capsules).
2. Ubiquinone is stable exposed to air with no oxidation.
3. Ubiquinone is dispersible in water, beverages, or gels.

Ubiquinone is the oxidized form of Coenzyme Q10, while Ubiquinol is the reduced form of CoQ10. Following the absorption of the oral dose, Ubiquinone is enzyme-converted back to Ubiquinol, and, Ubiquinol is enzyme-converted back to Ubiquinone, recycled according to the body’s cellular energy demand or to the reduction of oxidative cell damages. Ubiquinone and/or Ubiquinol play an important role in regenerating two internal antioxidants, vitamin E and vitamin C. Within the electron transport chain, the antioxidant ratio of Ubiquinol:Ubiquinone produces ATP for energy metabolism (exercise) upon demand. Some scientists argue that Ubiquinol is best absorbed, while others argue that their proprietary form of Ubiquinone is absorbed as well as Ubiquinol. Since both forms of exogenous Coenzyme Q10 are proposed to raise serum levels higher than the other, the question that case study examined is which form produces the most energy (if any) for endurance and performance? Coenzyme Q-10 is made inside the human body in the form of two alternating endogenous substances, (Ubiquinone ? Ubiquinol); the amounts available may effect energy production and/or health status. Acute deficiency of Coenzyme Q-10 has been associated with fatigue and exercise intolerance, while chronic deficiency has been associated with more serious health issues such as cerebellar ataxia, obesity, cardiovascular heart disease, hypertension, Muscular Dystrophy, HIV, AIDS, Parkinson’s, and Periodontal Disease (Dhanasekaran & Ren 2005, Gaby 1999).

With aging, the body makes by the mitochondria cells less Coenzyme Q10 that significantly lowers energy metabolism and compromising health (Lenaz, G., et al.1998). Mitochondria, located inside all living cells, produces Coenzyme Q-10 (Ubiquinone and Ubiquinol) for energy production and healthy cell function. Half of the body’s total Coenzyme Q10 originates in mitochondrion where it performs three vital functions (Barbiroli, B., et al 1997; Papucci, L., et al. 2003):
1. Assists enzymes in the mitochondria to convert dietary nutrients into adenosine triphosphate
2. Exerts antioxidant effects against free radicals generated during the energy-producing process
3. Protects the structural integrity of the mitochondrial membrane

Subject Food Choice and CoQ10-deficiency

The subject in this case report is an avowed
vegetarian for control of elevated cholesterol levels. Meats from livestock-fish-poultry [3.0-3.5-ounces] that contain the most Coenzyme Q10 are also higher in fat that tend to raise cholesterol levels:

Not-Healthy (high-fat) Foods CoQ-10 content [3.0-3.5-ounces]:
- Beef 2.60mg
- Herring 2.30mg
- Chicken 1.40mg

Healthy (low-fat) Foods CoQ-10 content is small [3.0-3.5-ounces]:
- Spinach 1.00mg
- Broccoli 0.86mg
- Rice Bran 0.54mg
- Sweet Potato 0.36mg
- Wheat Germ 0.35mg
- Soybeans 0.29mg
- Garlic 0.27mg
- Carrot 0.22mg
- Eggplant 0.21mg

Methods

Running performance slows down with age in years, months, and days. Loss of performance deteriorates approximately 0.6-1.0% per year. Because this case study required 180-days taking supplements and 14-days without taking supplements, the World Masters Athletics (WMA) WAVA-Age-grading calculator was selected to fairly compare all 21-timed runs of a 71-year age male subject on a same 15K trail course. The timed performances were age-graded by percentage of the world record 15K road race by age (in years, months, and days). All timed runs were recorded on the 2010 USA National 15K Championship trail course over a period of 194-days. This subject trained 5-days per week for 90-days to attain a base level of fitness.

Heart rate determined full recovery prior to each timed trial and the heart rate from the Karvonen formula was used to confirm an all-out effort after. Resting heart rate was between 51-56 bpm prerequisite to each timed run. If resting heart rate was greater than 56bpm, the timed trial was cancelled until recovery was confirmed with a 56bpm resting heart rate or less. Finishing heart rate of this 71-year male runner after all 21-timed runs ranged between 156-164bpm, indicating 105-110% maximum heart rate effort based on the Karvonen formula (220-71y=149bpm = 100% Max heart Rate).

After the first 90-day period was completed, the subject commenced oral dose of 400 mg Ubiquinol daily for 90-days. During the second 90-day period, of twelve-timed trail runs recorded, the best time was 1:28:03. Immediately following completion of the second 90-day period, this subject commenced oral dose of 400 mg Ubiquinone daily for the third 90-day period. Of eight timed 15K trail runs recorded; the best was 1:23:53. After this third 90-day period, the subject fasted both Ubiquinol and Ubiquinone for 14-day washout period prior to recording his final 15K timed trail run in 1:26:58. Age-grading this subject’s timed performances precisely identified which timed run during each of two 90-day periods and one 14-day washout no-supplement period was faster or slower based on percentage of the world record 15K road race by exact age (in years, months, and days).

Results

Twenty-one (21) timed 15K trail runs recorded in 194-days. The best-timed runs during each dose or no dose period occurred at age 71.20 during the Ubiquinol-dose period, at age 71.47 during the Ubiquinone-dose period, and at age 71.62 immediately following a 14-day no-supplement washout period. The best-timed run was determined according to the percentage of the age-graded world record 15K road race for precise runner-age in years and days as listed in Table I.

Discussion

The average Coenzyme Q10 turnover every 4-days in a healthy person is 500 milligrams depending upon endogenous cellular production or exogenous dietary dose (Ernster 1995). A healthy young person (age 20) stores a range estimate of 1400-2000 milligrams inside the cells. Specific foods either supply Coenzyme Q10 or the substances that the cells convert inside for cell stores. In the absence of exogenous sources (Example: 7-day fast), Coenzyme Q10 levels may decrease by -50%. Exercise also decreases circulating Q-10 plasma levels observed in runners immediately following exercise (Bargossi, A. M., et al. 1993). Supplemental Coenzyme Q-10 dose increases plasma levels, reduces muscle cell oxidant damages, and increases energy metabolism rebound for future exercise-demand (Gökbel et al., 2010; Bonetti A, et al., 2000; Cooke M, et al., 2008). Individual needs vary remarkably, from as little as 30 milligrams to as much as 500 milligrams/day, depending upon endogenous synthesis rate and exogenous dietary or supplement donors. Researchers reported endurance of athletes
supplementing CoQ10 who have higher muscle concentrations, and lower serum oxidative stress after exercise, resulting in increased exercise time to exhaustion (Cooke M, et al., 2008). When CoQ10 saturates tissues, health and energy metabolism appear to be optimal. Coenzyme Q-10 supplements prevent and resolve deficiencies immediately increase circulating plasma levels without elevating blood lipids (Quinzii et al., 2006). Exogenous Coenzyme Q-10’s half-life ranges between 33-72 hours, with blood serum concentrations peaking between 5-10 hours (6-hours average). Normal serum concentrations are 0.7-1.0 µg/mL. The therapeutic oral dose for maintaining healthy concentrations is 50-150 mg of Coenzyme Q10 per day (2 mg CoQ10 per kg of bodyweight/day). However, when a deficiency occurs, a higher oral dose is required to resolve. Aged individuals (over 70) have low Coenzyme Q-10 stores. Because since aging and exercise create a deficiency state, a daily oral dose of 400 mg CoQ10 daily has been proposed to improve cardiovascular senescent tolerance to aerobic exercise stress (Rosenfeldt et al., 1999). Peak performances recorded from this runner were 90-day training periods to attain peak performance at 15K trail run distance. This case reports a single subject 15K trail-run timed performances based on age-grading standards for 71.20-71.62-years was 2.28% faster while consuming 400 mg/day Ubiquinone than the same daily dose of Ubiquinol. This report begs the question whether a similar Ubiquinone loading protocol would benefit larger populations of other male and female runners of all ages. It must be emphasized that what occurred with this single male runner is a single case report, not a conclusive finding applicable to all populations.

Conclusions

Exogenous dose effects of Ubiquinol and Ubiquinone on steady state blood levels have been respectively examined, but without determining po transition effects to exercise performance. This case report collected 21-timed 15K trail running performances from a fit 71-y male runner over an extended 194-day period, 180-days taking supplemental Ubiquinol or Ubiquinone, and a 14-day washout period taking no supplements. This subject ran +2.28% faster while taking Ubiquinone, than taking no supplements [post-14-day washout]. However, while taking Ubiquinol, this subject ran -1.16% slower than without taking no supplements. To determine whether or not performance is associated with exogenous Ubiquinone or Ubiquinol, more research is required by examining placebo-double blind exogenous Ubiquinone and Ubiquinol-dose effects timed performance of male and female runners of all age ranges.

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References

Illustrations

Illustration 1

TABLE I. COENZYME Q-10 DOSE EFFECT ON RUNNERS PERFORMANCES

<table>
<thead>
<tr>
<th>COQ-10 FORM</th>
<th>SUBJECT AGE</th>
<th>WMA % WAVA AGE-GRADED WORLD RECORD</th>
<th>TIMED RUN USA NATIONAL CHAMPIONSHIP 15K TRAIL COURSE DATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBIQUINOL</td>
<td>71.20 yrs</td>
<td>64.71%</td>
<td>1:28:03 5-4-11</td>
</tr>
<tr>
<td>UBIQUINONE</td>
<td>71.47 yrs</td>
<td>68.15%</td>
<td>1:23:53 8-13-11</td>
</tr>
<tr>
<td>BASE: NO DOSE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 DAY WASHOUT</td>
<td>71.625 yrs</td>
<td>65.87%</td>
<td>1:26:58 10-8-11</td>
</tr>
</tbody>
</table>
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