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Plasma Carotenoid Levels before and after Supplementation with a Carotenoid Complex

ARIANNA CARUGHI AND FRED HOOPER

Neo-Life Company of America
P.O. Box 5012
Fremont, California 94537-5012

Carotenoids may be important cellular antioxidants in animals and man. Interest in the absorption, utilization and metabolism of carotenoids, especially beta-carotene, has been stimulated by several reports from epidemiological studies that suggest these compounds protect against degenerative diseases such as certain cancers, heart disease and macular degeneration.[1] It has been shown that purified beta-carotene raises plasma levels of beta-carotene whereas carotenoid-containing foods increase levels of other carotenoids.[2] Plasma response to supplements containing beta-carotene along with other carotenoids has not been established. In this study we determined changes in beta-carotene, alpha-carotene and lycopene in volunteers given a daily supplement of carotenoids from a carotenoid complex while on a low-carotenoid diet.

Eleven healthy men and women volunteers participated in the study. TABLE 1 shows their characteristics and biochemical indices. Participants ate a diet of natural foods but low in carotenoids for 6 weeks. We estimated that their daily diet would provide less than 0.4 mg of beta-carotene and alpha-carotene and 0 mg of lycopene. After 2 weeks on this low carotenoid diet, they began supplementation with a fruit and vegetable concentrate that provided a total dose of 8.5 mg beta-carotene, 3.5 mg alpha-carotene and 0.5 mg of lycopene per day. Supplementation continued for the next four weeks. Fasting blood samples for carotenoid analysis were collected at the beginning of the study (baseline), after two weeks on the low-carotenoid diet and weekly thereafter. Beta-carotene, alpha-carotene and lycopene levels were quantified using the HPLC method described by Bieri *et al.*[3] Fasting blood samples to determine HDL-cholesterol, LDL-cholesterol and VLDL-cholesterol, total cholesterol and triglyceride values were collected before the beginning, and at the end of supplementation.

During the first two weeks, when volunteers consumed a low-carotenoid diet, the levels of all carotenoids fell significantly (TABLE 2). Alpha- and beta-carotene levels increased significantly after supplementation. Lycopene levels, however, did not increase rapidly during the supplementation period. This is the first study reporting plasma alpha-carotene response to a carotenoid supplement. It shows that carotenoid intake has a rapid and important influence on plasma levels.

Supplements of purified beta-carotene are more effective than fruits and vegetables in raising plasma beta-carotene levels. However, intake of purified beta-carotene does not increase levels of other carotenoids also found in these foods. In this study, supplementation with a carotenoid complex made from fruit and vegetable concentrates significantly increased plasma levels of beta- *and* alpha-carotene. Since carotenoids other than beta-carotene may also offer specific protection against certain degenerative diseases, this type of supplementation may provide an advantageous alternative to supplementing with only beta-carotene.

TABLE 1. Characteristics and Biochemical Indices for the Study Participants before and after Supplementation with a Carotenoid Complex[a]

	Men (n = 4)		Women (n = 7)	
Age	45.8 ± 4.7		37.9 ± 8.4	
Body Mass Index[b]	24.0 ± 1.8		21.5 ± 1.0	
	Before	After	Before	After
	(mg/dL)		(mg/dL)	
Triglycerides	133 ± 54	146 ± 21	65 ± 23	101 ± 18
Cholesterol	233 ± 41	217 ± 44	185 ± 21	185 ± 27
HDL-cholesterol	36 ± 6	31 ± 7	55 ± 16	48 ± 15
VLDL-cholesterol	27 ± 6	29 ± 6	13 ± 4	20 ± 3
LDL-cholesterol	170 ± 41	156 ± 44	117 ± 12	117 ± 13

[a] X ± SD.
[b] Weight (in kg)/stature^2 (in m^2).

TABLE 2. Plasma Carotenoid Concentration in Subjects on a Low-Carotenoid Diet at Baseline and before and after 4 Weeks of Supplementation with a Carotenoid Complex[a]

	Baseline (ng/mL)	Before (ng/mL)	After (ng/mL)
Beta-carotene	462 ± 318	269 ± 177[b]	778 ± 428[b,c]
Alpha-carotene	165 ± 110	99 ± 62[b]	357 ± 168[b,c]
Lycopene	481 ± 193	282 ± 87[b]	305 ± 82

[a] X ± SD (n = 11).
[b] Change significantly different from baseline ($p < 0.05$).
[c] Change significantly different from before supplementation ($p < 0.05$).

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