Transport of Beta-Carotene in Serum of Individuals with Carotenemia

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We studied distribution of carotene in the various serum lipid fractions of carotenemic and noncarotenemic individuals. We found that the amount of carotene in each lipoprotein fraction is increased in the serum from carotenemic individuals, but that the relative increase is significant only in the low-density lipoprotein and high-density lipoprotein fractions. There was no significant difference between the cholesterol concentrations of each fraction of the carotenemic individuals' and noncarotenemic individuals' sera, indicating that serum beta-lipoprotein is not increased in carotenemia.

Krinsky et al. (1) studied transport of carotenoids in human serum, and found that the hydrocarbon carotenoids, beta-carotene and lycopene, are transported by the serum lipoproteins. About 75% of the pigments are found in the low-density (beta) lipoprotein (LDL) fraction and the rest in the high-density alpha lipoprotein (HDL) fraction (1). An opportunity had arisen to determine if there were any difference in the distribution of carotene between the various lipid fractions in the case of individuals made carotenemic by the ingestion of relatively large amounts of pure beta-carotene (2).

Materials and Methods

Blood was drawn from five volunteer men who were taking beta-carotene (180 mg/day for 10 weeks) and from five similar volunteers who were taking a placebo (2). The serum was separated from the erythrocytes and was transported to Boston under refrigeration. The serum lipoproteins were separated by the method of Hatch and Lees (3), carotenones were separated by a modified method of Sobel and Snow (4) (in which diethyl ether was used as an extraction solvent instead of petroleum ether), and cholesterol was determined with the Technicon AutoAnalyzer (5).

Results and Discussion

Table 1 lists the amounts and percentages of the total carotene and cholesterol in each of the plasma lipoprotein fractions. It can be seen that the absolute amount of carotene in each lipoprotein fraction has increased in the serum of the individuals taking carotene. The relative increase (as measured by percentage total carotenoid) of carotene is significant only in the LDL and HDL fractions (LDL, P between .025 and .0125; HDL, P between .05 and .025). Table 1 also shows that there is no significant increase in the cholesterol concentrations of each fraction in the individuals taking carotene as compared with the placebo group. Because the cholesterol concentration of the various lipoprotein fractions is used to indicate the lipoprotein concentration in a given fraction, the lack of increase of cholesterol of the various lipoprotein fractions of the carotene group suggests that carotenemia did not produce an increase in serum lipoprotein concentration. Rather, the lipoprotein fractions that carry carotenoids in the blood evidently have ample binding capacity for carotene, even when carotene intake is high. From the present data we cannot say whether these binding sites are completely saturated. Serum carotene concentrations reach a constant value after about four weeks when a dose of 180 mg of carotene per day is given, the highest dose we used (Mathews-Roth, unpublished observations), but it is not yet clear whether this leveling off is due to inability to absorb more carotene or to a saturation of the lipoprotein binding sites for carotene. Our findings also agree with those of Krinsky et al. (1) that most of the carotenoids are in the beta-lipoprotein fraction. We did, however, find a larger amount of carotene in the very-low-density lipoprotein fraction (S<sub>r</sub> 20-400) than did Krinsky et al. This could be attributed to the difference in fractionation methods used.
Table 1. Concentration and Percentage of Total Carotene and Cholesterol in the Various Serum Lipoprotein Fractions of Five Carotenemic and Five Noncarotenemic Volunteers

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This work was supported by a grant (AM 14545) from the NIAMD, NIH.

References