

Body Weight Plasma/Serum Lycopene and Disease Risk

Disease type	First Author	Study Title and Complete Citation	Date	Abstract	Study Type	G.Tom +, N, -	P.Tom +, N, -	F.Tom +, N, -	Lyco +, N, -	Other +, N, -
BW	Ribaya-Mercado JD	Relationships of body mass index with serum carotenoids, tocopherols and retinol at steady-state and in response to a carotenoid-rich vegetable diet intervention in Filipino schoolchildren. Ribaya-Mercado JD, Maramag CC, Tengco LW, Blumberg JB, Solon FS. Biosci Rep. 2008 Apr;28(2):97-106. Compound (MeSH Keyword),	2008	In marginally nourished children, information is scarce regarding the circulating concentrations of carotenoids and tocopherols, and retinol at steady state and in response to a 9-week vegetable diet intervention in 9-12-year-old girls (n=54) and boys (n=65) in rural Philippines. We determined cross-sectional relationships of BMI (body mass index) with serum micronutrient levels, and whether BMI is a determinant of serum carotenoid responses to the ingestion of carotenoid-rich vegetables. We measured dietary nutrient intakes and assessed inflammation by measurement of serum C-reactive protein levels. The children had low serum concentrations of carotenoids, tocopherols and retinol as compared with published values for similar-aged children in the U.S.A. The low serum retinol levels can be ascribed to inadequate diets and were not the result of confounding due to inflammation. Significant inverse correlations of BMI and serum all-trans-beta-carotene, 13-cis-beta-carotene, alpha-carotene, lutein, zeaxanthin and alpha-tocopherol (but not beta-cryptoxanthin, lycopene and retinol) were observed among girls at baseline. The dietary intervention markedly enhanced the serum concentrations of all carotenoids. Changes in serum all-trans-beta-carotene and alpha-carotene (but not changes in lutein, zeaxanthin and beta-cryptoxanthin) in response to the dietary intervention were inversely associated with BMI in girls and boys. Thus, in Filipino school-aged children, BMI is inversely related to the steady-state serum concentrations of certain carotenoids and vitamin E, but not vitamin A, and is a determinant of serum beta- and alpha-carotene responses, but not xanthophyll responses, to the ingestion of carotenoid-rich vegetable meals.	CS				N	
BW	Vioque J	Plasma concentrations of carotenoids and vitamin C are better correlated with dietary intake in normal weight than overweight and obese elderly subjects. Vioque J, Weinbrenner T,	2007	Carotenoid and vitamin C intakes, assessed by FFQ, have been positively associated with plasma concentrations in different populations. However, the influence of BMI on these associations has not been explored in detail. We explored in a cross-sectional study the relation between dietary carotenoid and vitamin C intakes, using a 135-item FFQ, with their plasma concentrations by BMI categories in 252 men and 293 women, 65 years and older. For men and women combined, significant (P < 0.05) Pearson correlations were observed between energy-adjusted dietary intakes and plasma concentrations (carotenoids adjusted for cholesterol) for: alpha-carotene 0.21, beta-carotene 0.19, lycopene 0.18, beta-cryptoxanthin 0.20 and vitamin C 0.36. Multiple linear regression analyses showed that the intake of	CS				(-) ↓ plasma [lyco] with ↑ BMI	

		Asensio L, Castella A, Young IS, Fletcher A. Br J Nutr. 2007 May;97(5):977-86.		carotenoids and vitamin C were significant predictors of their respective plasma concentration (P<0.01), and that BMI was inversely associated with plasma concentration of carotenoids (P< or =0.01) but not with plasma vitamin C. In addition, we observed significant interactions between BMI and the intakes of alpha-carotene and lutein + zeaxanthin, and to a lower extent beta-carotene, suggesting that these intakes in subjects with high BMI were not good predictors of their plasma concentration. The present data suggest that plasma carotenoids and vitamin C may be good markers of dietary intake in elderly subjects, but not so for alpha-carotene, beta-carotene and lutein + zeaxanthin in obese subjects.			
BW	Kimmons JE	Associations between body mass index and the prevalence of low micronutrient levels among US adults. Kimmons JE, Blanck HM, Tohill BC, Zhang J, Khan LK. MedGenMed. 2006 Dec 19;8(4):59.	2006	BACKGROUND: Low micronutrient levels observed with increasing adiposity may result from inadequate nutrient intake and/or alterations in nutrient metabolism. OBJECTIVE: To examine the association between body mass index (BMI) and micronutrient levels among a nationally representative sample of US adults aged > or = 19 years. DESIGN: Using nationally representative cross-sectional data from the National Health and Nutrition Examination Survey III (NHANES III), we examined odds ratios of low micronutrient levels using logistic regression adjusting for covariates. MEASUREMENTS: Nutritional biomarker levels (as indicated by serum levels of total carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein/zeaxanthin, lycopene, vitamin E, vitamin C, selenium, vitamin A, vitamin D, folate, vitamin B12, and red blood cell folate) among men and nonpregnant women, by BMI category. RESULTS: Overweight and obese adults had higher odds of low levels for a number of nutrients compared with normal-weight adults. Odds of being low in multiple micronutrients was most common among overweight and obese premenopausal women. CONCLUSION: These findings underscore the need for further assessment of specific micronutrient inadequacies among persons who are overweight or obese. Specifically, research is needed to determine whether these inadequacies are due to insufficient dietary intake, altered metabolic processes, or both.	CS	(-)	↑ BMI ↓ serum lyco in OW/OB vs HW
BW	Grolier P	Age-related changes in plasma lycopene	2000	The aim of the present study was to assess the influence of age on plasma concentration of alpha-tocopherol, retinol and carotenoids with a special attention paid to natural differences in	Interv	(-+)	plasma

concentrations, but not in vitamin E, are associated with fat mass.

Grolier P, Boirie Y, Levadoux E, Brandolini M, Borel P, Azais-Braesco V, Beaufrere B, Ritz P.

Br J Nutr. 2000 Nov;84(5):711-6.

body composition. Forty healthy subjects were recruited: twenty were less than 35 years old and twenty above 60 years old. Males and females were equally represented in each age group. Subjects were kept in energy balance and received controlled diets for 36 h. Fat mass and fat-free mass were determined with the (18)O-enriched water dilution technique. Plasma vitamins A and E, and carotenoid levels were determined after 12 h fasting and were shown to be similar in women and men. Plasma alpha-tocopherol concentration increased with age (+44 % elderly v. young), and correlated with % fat mass and plasma cholesterol. After adjustment for plasma cholesterol, the effect of age and % fat mass disappeared. In contrast, plasma lycopene level was 2-fold lower in the elderly than in the young group, and was inversely correlated with fat mass. When lycopene values were adjusted for fat mass, the effect of age disappeared. These results suggest that plasma levels of vitamin E and lycopene differed in the two age groups and that differences in plasma cholesterol and fat mass might participate in such an effect. Short-term vitamin intake did not appear to influence plasma vitamin concentrations.

[lyco] 2x lower in old vs young
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N

adj for fat mass, no age effect

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↓ with ↑ age

BW	Anderson LF	Longitudinal associations between body mass index and serum carotenoids: the CARDIA study. Andersen LF, Jacobs DR Jr, Gross MD, Schreiner PJ, Dale Williams O, Lee DH. Br J Nutr. 2006 Feb;95(2):358-65.	2006	Cross-sectional studies report an inverse association between BMI and serum carotenoid concentration. The present study examined the prospective association between BMI and the serum concentration of five carotenoids in the Coronary Artery Risk Development in Young Adults (CARDIA) study. Serum carotenoids (alpha-carotene, beta-carotene, beta-cryptoxanthin, zeaxanthin/lutein, lycopene), BMI, dietary intake, physical activity and dietary supplement use were measured at years 0 and 7 in 3071 black and white male and female participants, who were either persistent smokers or non-smokers. Among non-smokers, year 0 BMI predicted year 7 serum carotenoid levels: obese subjects (BMI > or =30 kg/m2) had an average concentration of the sum of four carotenoids (alpha-carotene +beta-carotene + zeaxanthin/lutein+beta-cryptoxanthin) that was 22 % lower than the concentration among subjects with a BMI of less than 22 kg/m2. In contrast, the sum of carotenoids among smokers was only 6 % lower. Relationships between BMI and serum lycopene were weak. The change from year 0 to year 7 in serum carotenoids, except for lycopene, was inversely associated with the change in BMI among non-smokers but not among smokers. Parallel findings were observed for BMI and serum gamma-glutamyl transferase level. In summary, the observation that BMI predicted the evolution of serum carotenoids during a 7-year follow-up among young non-smoking adults is consistent with the hypothesis that carotenoids are decreased in protecting against oxidative stress generated by adipose tissue, while smokers maintain a minimal level of serum carotenoids independent of	PC	N	BMI
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				adiposity. The results for lycopene were, however, discordant from those of the other carotenoids.		
BW	Dancheck B	Status of carotenoids, vitamin A, and vitamin E in the mother-infant dyad and anthropometric status of infants in Malawi. Dancheck B, Nussenblatt V, Kumwenda N, Lema V, Neville MC, Broadhead R, Taha TE, Ricks MO, Semba RD. J Health Popul Nutr. 2005 Dec;23(4):343-50.	2005	This prospective study was carried out during February 2000-April 2003 to characterize the relationship between the status of carotenoids, vitamin E, and retinol and anthropometric status in apparently healthy infants and their mothers in Blantyre, Malawi. Anthropometric status of infants and concentrations of carotenoids (alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein, zeaxanthin, and lycopene), retinol, and alpha-tocopherol in plasma were measured in 173 infants at 12 months of age, and concentrations of carotenoids, retinol, and alpha-tocopherol in plasma were measured in their mothers two weeks postpartum. In multivariate analyses, concentrations of retinol, total carotenoids, non-provitamin A carotenoids, and alpha-tocopherol in infants were associated with under-weight (p = 0.05). Concentrations of alpha-tocopherol were associated with wasting (p = 0.04). Concentrations in mothers and infants were all correlated (correlation coefficients from 0.230 to 0.502, p < 0.003). The findings suggest that poor status of carotenoids, retinol, and alpha-tocopherol in infants is associated with their poor anthropometric status, and status of carotenoids, retinol, and alpha-tocopherol in mothers and infants has a low-to-moderate association in the mother-infant dyad.	PC	(-) ↓ plasma [lyco] = underweight
BW	Shin MJ	Plasma levels of leptin are associated with the plasma levels of LDL conjugated dienes in children. Shin MJ, Park E. Ann Nutr Metab. 2007;51(1):1-6. Epub 2007 Jan 24.	2007	BACKGROUND: Plasma leptin has been suggested to be involved in the proatherogenic process by increasing oxidative stress. We investigated the relationship between leptin and plasma conjugated diene formation, a measure of LDL oxidation in vivo in schoolchildren. METHODS: We measured blood lipid profiles, plasma antioxidant vitamins, leptin and diene conjugation in LDL of 118 Korean children (35 overweight-obese vs. 83 normal weight children). RESULTS: The overweight-obese children showed significantly higher levels of leptin (p < 0.0001), conjugated dienes (p = 0.02), total cholesterol (p < 0.05), triglyceride (p < 0.005) and LDL cholesterol (p < 0.01) and a significantly lower level of plasma lycopene (p < 0.0001) compared with the normal weight children. When all the subjects were classified into the three groups by tertiles of leptin levels, significant differences in circulating conjugated dienes (p < 0.05), lipid-corrected lycopene (p < 0.05), total cholesterol (p < 0.05), triglyceride (p < 0.05) and LDL cholesterol (p < 0.05) were found among the three groups.	CS	(-) ↓ lyco (plasma) with ↑ BMI (-) Lipids Ox

				CONCLUSION: Our results showed that leptin was positively associated with the LDL conjugated diene formation, which might be related to the proatherogenic process in schoolchildren			
BW	Markovits N	The effect of tomato-derived lycopene on low carotenoids and enhanced systemic inflammation and oxidation in severe obesity. Markovits N, Ben Amotz A, Levy Y. Isr Med Assoc J. 2009 Oct;11(10):598-601.	2009	<p>BACKGROUND: Fat tissue mediates the production of inflammatory cytokines and oxidative products, which are key steps in the development of type 2 diabetes and atherosclerosis. Antioxidant-rich diets protect against chronic diseases. Antioxidants may interfere with pro-inflammatory signals.</p> <p>OBJECTIVES: To investigate the effect of the potent tomato-derived antioxidant carotenoid, lycopene, on plasma antioxidants (carotenoids and vitamin E), inflammatory markers (C-reactive protein, interleukin-6, tumor necrosis factor-alpha) and oxidation products (conjugated dienes).</p> <p>METHODS: Eight obese patients (body mass index 37.5 +/- 2.5 kg/m²) were compared with a control group of eight lean, age and gender-matched subjects (BMI 21.6 +/- 0.6 kg/m²), before and after 4 weeks of lycopene supplementation (tomato-derived Lyc-O-Mato) (30 mg daily).</p> <p>RESULTS: Plasma carotenoids were significantly reduced in the obese compared to control subjects (0.54 +/- 0.06 vs. 0.87 +/- 0.08 microg/ml, P < 0.01). CRP levels were significantly higher (6.5 vs. 1.1 mg/L, P = 0.04) in obese vs. controls, as were IL-6 and conjugated dienes (3.6 and 7.9-fold, respectively). CRP, IL-6 and conjugated dienes correlated with BMI, while IL-6 and conjugated dienes correlated inversely with carotenoids (P < 0.05). Following lycopene treatment, a significant elevation of plasma carotenoids (1.79 vs. 0.54 microg/ml) and specifically lycopene (1.15 vs 0.23 microg/ml) (P < 0.001) occurred in the treatment vs. the placebo group, respectively. Markers of inflammation and oxidation products were not altered by lycopene.</p> <p>CONCLUSIONS: Obese patients showed abnormally higher markers of inflammation and oxidation products and lower plasma carotenoids. The lack of reduction of pro-inflammatory markers could be attributed to the short period of the study and the small number of participants. More studies are needed on the protective qualities of natural antioxidant-rich diets against obesity-related co-morbidities.</p>	Interv	N inflam Ox	(-) Plasma lyco ↓ with ↑ BMI
BW	Chai	Associations between obesity and serum lipid-soluble	2010	Elucidating potential pathways that micronutrients may reduce/promote chronic disease may contribute to our understanding of the underlying etiology of disease and their utility as markers of risk. In the current study, we examined associations	CS	N OB	OB vs. NW no difference

micronutrients
among
premenopausal
women.

Chai W, Conroy
SM, Maskarinec G,
Franke AA,
Pagano IS,
Cooney RV.

Nutr Res. 2010
Apr;30(4):227-32.

of serum lipid-soluble micronutrients with body mass index (BMI). We hypothesized that obesity may differentially influence serum micronutrient levels, thereby affecting risk for chronic disease incidence and mortality. Baseline serum samples from 180 premenopausal women from a nutritional trial were analyzed for leptin, C-reactive protein, 25-hydroxyvitamin D, carotenoids, and tocopherols. Participants were stratified into normal-weight (18.5-24.9), overweight (25-29.9), and obese (≥ 30) subgroups by BMI (in kilograms per square meter). Differences in serum biomarkers among BMI subgroups were adjusted for Asian ethnicity and smoking status. As expected, obese individuals had significantly higher serum levels of leptin and C-reactive protein ($P < .05$) compared with normal-weight women. gamma-Tocopherol levels were significantly higher in obese individuals ($P < .05$), whereas alpha-tocopherol levels did not differ among BMI subgroups. Serum levels of 25-hydroxyvitamin D and carotenoids (except lycopene) were significantly lower in obese than in normal-weight women ($P < .05$). The associations between BMI and carotenoids were independent of dietary intake. The obesity-associated reduction for total provitamin A carotenoids (45%) was approximately 3-fold greater than that observed for non-provitamin A carotenoids (16%). Our results indicate potential influences of obesity on serum levels of lipid-soluble micronutrients and suggest that metabolism of provitamin A carotenoids may contribute to the differences observed.

with
lycopene