## CARDIOVASCULAR DISEASE (CVD)
## Dietary 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, - |
|---|---|---|---|---|---|---|---|---|---|---|
| Heart | Osganian SK | Dietary carotenoids and risk of coronary artery disease in women.<br><br>Osganian SK, Stampfer MJ, Rimm E, Spiegelman D, Manson JE, Willett WC.<br><br>Am J Clin Nutr. 2003 Jun;77(6):1390-9. | 2003 | BACKGROUND: Numerous studies have shown that higher intakes or higher blood concentrations of carotenes are associated with a lower risk of coronary artery disease (CAD). Given the null results in trials of beta-carotene supplementation, considerable attention has focused on the potential role of other dietary carotenoids in the prevention of CAD. OBJECTIVE: Our objective was to prospectively examine the relation between dietary intakes of specific carotenoids and risk of CAD in women. DESIGN: In 1984, 73 286 female nurses completed a semiquantitative food-frequency questionnaire that assessed their consumption of carotenoids and various other nutrients. The women were followed for 12 y for the development of incident CAD (nonfatal myocardial infarction and fatal CAD), and dietary information was updated in 1986, 1990, and 1994. RESULTS: During 12 y of follow-up (803 590 person-years), we identified 998 incident cases of CAD. After adjustment for age, smoking, and other CAD risk factors, we observed modest but significant inverse associations between the highest quintiles of intake of beta-carotene and alpha-carotene and risk of CAD but no significant relation with intakes of lutein/zeaxanthin, lycopene, or beta-cryptoxanthin. For women in the highest compared with the respective lowest quintile of intake, the relative risks for beta-carotene and alpha-carotene were 0.74 (95% CI: 0.59, 0.93) and 0.80 (95% CI: 0.65, 0.99), respectively. The association between the specific carotenoids and CAD risk did not vary significantly by current smoking status. CONCLUSION: Higher intakes of foods rich in alpha-carotene or beta-carotene are associated with a reduction in risk of CAD. | PC | | | | N<br><br>CAD | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Heart: endothelial | Rowley K | Inflammation and vascular endothelial activation in an Aboriginal population: relationships to coronary disease risk factors and nutritional markers.<br><br>Rowley K, Walker KZ, Cohen J, Jenkins AJ, O'Neal D, Su Q, Best JD, O'Dea K.<br><br>Med J Aust. 2003 May 19;178(10):495-500. | 2003 | OBJECTIVE: To describe the levels of inflammation and vascular endothelial activation in an Aboriginal community, and the relationship of these factors to coronary heart disease (CHD) risk factors and markers of nutritional quality.<br>DESIGN AND PARTICIPANTS: A cross-sectional survey of 95 women and 76 men participating in a chronic-disease prevention program.<br>SETTING: A remote Aboriginal community in Western Australia in 1996.<br>MAIN OUTCOME MEASURES: Concentrations of markers of inflammation (C-reactive protein [CRP]) and vascular endothelial activation (soluble E-selectin [sE-selectin]); presence of metabolic syndrome; concentrations of diet-derived antioxidants.<br>RESULTS: Participants exhibited very high plasma concentrations of CRP (mean, 5.4 mg/L; 95% CI, 4.6-6.3 mg/L) and sE-selectin (mean, 119 ng/mL; 95% CI, 111-128 ng/mL). Both CRP and sE-selectin concentrations were significantly higher in the presence of the metabolic syndrome. There were significant inverse linear relationships between concentrations of CRP<br>and plasma concentrations of the antioxidants lycopene, beta-carotene, cryptoxanthin and retinol. Even stronger inverse associations were evident between concentrations of sE-selectin and lycopene, beta-carotene, cryptoxanthin and lutein.<br>CONCLUSIONS: Vascular inflammation and endothelial activation may be important mediators of elevated CHD risk in Aboriginal people. Inadequate nutrition and physical inactivity may contribute to this process. | CS | | | | (-)<br><br>CRP<br>eSelectin | |
| Heart: MI | Tavani A | Dietary intake of carotenoids and retinol<br>and the risk of acute myocardial infarction in Italy.<br><br>Tavani A, Gallus S, Negri E, Parpinel | 2006 | BACKGROUND: Carotenoids may reduce the risk of coronary heart disease through their antioxidant properties, but the results of epidemiological studies are controversial. We analysed the relation between the intake of selected carotenoids and retinol and risk of acute myocardial infarction (AMI).<br>METHODS: A case-control study was conducted in Milan, Italy, in 1995-2003. Cases were 760 patients with nonfatal AMI, and controls 682 patients admitted to hospital. RESULTS: The risk of AMI decreased with increasing intake of alpha-carotene | CC | | | | N | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | M,<br>La Vecchia C.<br><br>Free Radic Res. 2006 Jun;40(6):659-64. | | (odds ratios, OR = 0.71, 95% confidence intervals, CI 0.51-0.98, for the highest vs the lowest quartile of intake), beta-carotene (OR = 0.71, 95% CI 0.50-1.01) and<br>beta-criptoxanthin (OR = 0.64, 95% CI 0.46-0.88). No associations emerged for total carotenoids, lycopene, lutein plus zeaxanthin and retinol. CONCLUSIONS: Our study suggests a weak protective effect of alpha-carotene, beta-carotene and beta-criptoxanthin on the risk of AMI. It also indicates that total carotenoids, lycopene, lutein plus zeaxanthin and retinol were not related to the risk of the disease. | | | | | | |
| Heart: MS | Sluijs I | Dietary carotenoid intake is associated with lower prevalence of metabolic syndrome in middle-aged and elderly men.<br><br>Sluijs I, Beulens JW, Grobbee DE, van der Schouw YT.<br><br>J Nutr. 2009 May;139(5):987-92. Epub 2009 Mar 25. | 2009 | Carotenoids have antioxidant properties. Little is known about the relation of dietary carotenoid intake on metabolic syndrome risk. We examined whether dietary carotenoid intake was associated with metabolic syndrome and metabolic syndrome risk<br>factors. We conducted a population-based, cross-sectional study in 374 men aged 40-80 y. Intakes of beta-carotene, alpha-carotene, beta-cryptoxanthin, lycopene, lutein, and zeaxanthin were estimated using a validated FFQ. Presence of metabolic syndrome was determined using fasting serum glucose, triglyceride, and HDL-cholesterol concentrations, waist circumference, and systolic and diastolic blood pressure. Metabolic syndrome was present in 22% of the men. After adjustment for confounders, total carotenoid and lycopene intakes were inversely associated with presence of metabolic<br>syndrome [relative risk (RR) quartile 4 vs. quartile 1 (95% CI) 0.42 (0.20-0.87), P-trend 0.02; and 0.55 (0.28-1.11), P-trend 0.01, respectively]. For beta-carotene, a decreased risk was observed for each quartile of intake compared with the first [RR quartile 4 vs. quartile 1 (95% CI) 0.58 (0.33-1.02)]. Higher total carotenoid, beta-carotene, alpha-carotene, and lycopene intakes were associated with lower waist circumferences and visceral and subcutaneous fat mass. Higher lycopene intake was related to lower serum triglyceride concentrations. In conclusion, higher total carotenoid intakes, mainly those of beta-carotene and lycopene, were associated with a lower prevalence of metabolic syndrome and with | CS | | | | (-)<br><br>↓ MS, waist, visceral fat, sub Q fat, TG | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lower measures of adiposity and serum triglyceride concentrations in middle-aged and elderly men. | | | | | | |
| Heart: oxidation | Maruyama C | Effects of tomato juice consumption on plasma and lipoprotein carotenoid concentrations and the susceptibility of low density lipoprotein to oxidative modification.<br><br>Maruyama C, Imamura K, Oshima S, Suzukawa M, Egami S, Tonomoto M, Baba N, Harada M, Ayaori M, Inakuma T, Ishikawa T.<br><br>J Nutr Sci Vitaminol (Tokyo). 2001 Jun;47(3):213-21 | 2001 | Effects of tomato juice supplementation on the carotenoid concentration in lipoprotein fractions and the oxidative susceptibility of LDL were investigated in 31 healthy Japanese female students. These subjects were randomized to one of three treatment groups; Control, Low and High. The Control, Low and High groups consumed 480 g of a control drink, 160 g of tomato juice plus 320 g of the control drink, and 480 g of tomato juice, providing 0, 15 and 45 mg of lycopene, respectively, for one menstrual cycle. The ingestion of tomato juice, rich in lycopene but having little beta-carotene, increased both lycopene and beta-carotene. Sixty-nine percent of lycopene in plasma was distributed in the LDL fraction and 24% in the HDL fraction. In the Low group, the lycopene concentration increased 160% each in the VLDL+IDL, LDL and HDL fractions ($p<0.01$). In the High group, the lycopene concentration increased 270% each in the VLDL+IDL and LDL fractions, and 330% in the HDL fraction ($p<0.01$). Beta-carotene also increased 120% and 180% in LDL fractions of the Low and the High groups, respectively. Despite these carotenoid increases in LDL, the lag time before oxidation was not prolonged as compared with that of the Control group. The propagationrate decreased significantly after consumption in the High group. Multiple regression analysis showed a positive correlation between lag time changes and changes in the alpha-tocopherol concentration per triglyceride in LDL, and a negative correlation between propagation rate changes and changes in the lycopene concentration per phospholipid in LDL. These data suggest that alpha-tocopherol is a major determinant in protecting LDL from oxidation, while lycopene from tomato juice supplementation may contribute to protect phospholipid in LDL, from oxidation. Thus, oral intake of lycopene might be beneficial for ameliorating atherosclerosis. | RCT | | N/(-) | | | LDL Ox<br><br>Prop rate |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Heart: oxidation | Ahuja KD | Effects of two lipid-lowering, carotenoid-controlled diets on the oxidative modification of low-density lipoproteins in free-living humans.<br><br>Ahuja KD, Ashton EL, Ball MJ.<br><br>Clin Sci (Lond). 2003 Sep;105(3):355-61. | 2003 | This study compares the effects of two lipid-lowering diets [a diet enriched in MUFAs (monounsaturated fatty acids) and a HCLF (high-carbohydrate/low-fat) diet] with a controlled carotenoid content on risk factors for coronary heart disease, including in vitro copper-induced LDL (low-density lipoprotein) oxidation and serum lipid levels. A randomized crossover dietary intervention study, with two diets each consumed for 14-16 days, was conducted in 18 women and 13 men aged 20-70 years, recruited via personal contacts and advertisements in newspapers. Both diets (MUFA-enriched diet and HCLF diet) contained the same basic foods and had a controlled carotenoid content, high in lycopene. The in vitro copper-induced oxidation of isolated LDL showed a longer lag phase (mean difference 7.4 min in women and 7.34 min in men) after the MUFA-enriched diet compared with the HCLF diet. Serum total cholesterol, LDL cholesterol and carotenoid levels were similar after the two diets. Serum triacylglycerol levels were significantly lower and those of HDL (high-density lipoprotein) cholesterol were significantly higher at the end of the MUFA-enriched diet compared with the HCLF diet. It is concluded that the significantly longer lag phase for oxidation of LDL, the higher HDL cholesterol level and the lower triacylglycerol level in subjects following a carotenoid-controlled, MUFA-enriched diet may decrease the risk of coronary heart disease. | Interv<br><br>RCT study; however, comparison made as interv | | | | (-)<br><br>LDLox | |
| Heart: oxidation | Ahuja KD | Effects of olive oil and tomato lycopene combination on serum lycopene, lipid profile, and lipid oxidation.<br><br>Ahuja KD, Pittaway JK, Ball MJ.<br><br>Nutrition. 2006 Mar;22(3):259-65. Epub 2006 Jan 18. | 2006 | OBJECTIVE: We compared the effect of two diets (a diet high in olive oil and a diet high in carbohydrate and low in olive oil) with high lycopene content and other controlled carotenoids on serum lycopene, lipids, and in vitro oxidation.<br>METHODS: This was a randomized crossover dietary intervention study carried out in Launceston, Tasmania, Australia in healthy free-living individuals. Twenty-one healthy subjects who were 22 to 70 y old were recruited by advertisements in newspapers and a university newsletter. A randomized dietary intervention was done with two diets of 10 d each. One diet was high in olive oil and the other was high in carbohydrate and low in olive oil; the two diets contained the same basic foods and a controlled | Interv<br><br>RCT study; however, comparison made as interv | | | | N<br><br>lipid ox | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | carotenoid content high in lycopene.<br>RESULTS: Significant increases (P<0.001) in serum lycopene concentration on both diets were to similar final concentrations. Higher serum high-density lipoprotein cholesterol (P<0.01), lower ratio of total cholesterol to high-density lipoprotein (P<0.01), and lower triacylglycerols (P<0.05) occurred after the olive oil diet compared with the high-carbohydrate, low-fat diet. There was no difference in total antioxidant status and susceptibility of serum lipids to oxidation.<br><br>CONCLUSIONS: Serum lycopene level changes with dietary lycopene intake irrespective of the amount of fat intake. However, a diet high in olive oil and rich in lycopene may decrease the risk of coronary heart disease by improving the serum lipid profile compared with a high-carbohydrate, low-fat, lycopene-rich diet. | | | | | | |