CARDIOVASCULAR DISEASE (CVD)
Tomato/Tomato-based foods 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	Shidfar F	The effects of tomato consumption on serum glucose, apolipoprotein B, apolipoprotein A-I, homocysteine and blood pressure in type 2 diabetic patients. Shidfar F, Froghifar N, Vafa M, Rajab A, Hosseini S, Shidfar S, Gohari M. Int J Food Sci Nutr. 2011 May;62(3):289-94. Epub 2010 Dec 8.	2011	Tomatoes are a rich source of lycopene, β-carotene, potassium, vitamin C, flavonoids, folate and vitamin E that may provide protection against the development of type 2 diabetic patients, so the present study was undertaken to evaluate the effects of tomato intake on serum glucose, homocysteine, apolipoprotein (apo) B, apoA-I and blood pressure in type 2 diabetic patients. In a quasi-experimental study, 32 type 2 diabetes patients received 200 g raw tomato daily for 8 weeks. Serum glucose enzymatically, apoB and apoA-I immunoturbidometrically and homocysteine by high-performance liquid chromatography were measured at the beginning and end of 8 weeks. There were significant decreases in systolic and diastolic blood pressure and also a significant increase in apoA-I at the end of study compared with initial values (P = 0.0001, P = 0.0001 and P = 0.013, respectively). In conclusion, 200 g raw tomato per day had a favored effect on blood pressure and apoA-I so it might be beneficial for reducing cardiovascular risk associated with type 2 diabetes.	Interv			(-) ↓BP ↑ ApoA-1		Endpoints in T2DM are CVD
Heart: CHF	Wood N	The relationship between tomato intake and congestive heart failure risk in periodontitis	2004	BACKGROUND: The objective of this study was to investigate the relationship between monthly tomato consumption (MTC) and serum lycopene (sLyco) levels, and a self-reported history of congestive heart failure (CHF) in	CS	(-)			(-)	CRP

		subjects. Wood N, Johnson RB. J Clin Periodontol. 2004 Jul;31(7):574-80.		individuals with periodontitis using data available in the Third National Health and Nutrition Examination Survey (NHANES III). METHODS: Adult participants in NHANES III were used in this study. Zero to thirty three percent of sites with a periodontal attachment loss (PAL) of >3 mm was considered a healthy periodontium, while greater than >33% of sites with PAL of >3 mm as periodontitis. The outcome variable was the self-reported history of CHF. MTC and sLyco levels were categorized into quartiles. Data was analyzed by Kruskal-Wallis, anova and multivariate analyses using SPSS(R). $p<0.05$ was used to reject the null hypothesis. RESULTS: Individuals with periodontitis showed a dose-response relationship between dietary MTC and self-reported CHF risk; moderate MTC (risk ratio (RR), 3.15; 95% confidence interval (CI), 1.03-9.67), low MTC (RR, 3.31; 95% CI, 1.33-8.24) ($p<0.05$) and very low MTC (RR, 5.10; 95% CI, 1.67-15.57) ($p<0.01$), adjusting for confounders of both diseases (periodontitis and CHF). The moderate sLyco level-healthy periodontium group showed a significant decrease in CHF risk (RR, 0.25; 95% CI, 0.07-0.84) ($p<0.05$), adjusting for confounders. Significant inverse dose-response relationships were seen between sLyco and C-reactive protein, and MTC and white blood cell count in periodontitis subjects, respectively ($p<0.05$). MTC was correlated with sLyco concentration ($r=-0.018$, $p<0.05$), adjusting for confounders abolished that significance						

				CONCLUSIONS: A relationship exists between periodontitis and CHF risk, and high MTC appears to affect this relationship in a positive direction in periodontitis subjects.						
Heart: endothelial function	Stangl V	Lack of effects of tomato products on endothelial function in human subjects: results of a randomised, placebo-controlled cross-over study. Stangl V, Kuhn C, Hentschel S, Jochmann N, Jacob C, Böhm V, Fröhlich K, Müller L, Gericke C, Lorenz M. Br J Nutr. 2011 Jan;105(2):263-7. Epub 2010 Aug 24.	2011	Epidemiological studies suggest that consumption of tomato products reduces the risk of CVD via antioxidant, hypocholesterolaemic and anti-inflammatory mechanisms. Although experimental data also describe beneficial effects on endothelial function, clinical data in human subjects are lacking. To test the hypothesis that tomato ingestion ameliorates endothelial function, we randomised healthy non-smoking postmenopausal women to consume a buttered roll with and without tomato purée (70 g) in a cross-over design. Endothelial-dependent flow-mediated dilation (FMD) and endothelial-independent nitro-mediated dilation of the brachial artery were assessed with high-resolution ultrasound (13 MHz linear array transducer). Acute (24 h) and long-term (7 d) effects were examined after daily consumption of the described meal. Nineteen volunteers completed the protocol and provided technically suitable ultrasound measurement data. Plasma lycopene levels increased from 0·30 (sem 0·04) (baseline) to 0·42 (sem 0·04) and to 0·74 (sem 0·06) μm after 24 h and 7 d, respectively, with tomato purée consumption. These data indicated an effective absorption of the tomato product. However, both acute and long-term tomato purée consumption had no effects on endothelium-dependent or -independent dilation of the brachial artery. In addition, we found no correlation between lycopene plasma levels and FMD. In conclusion,	RCT		N			

				consumption of tomato products associated with a significant increase in plasma lycopene levels had no effects on endothelial function in healthy postmenopausal women.						
Heart: IMT	Liese AD	Food intake patterns associated with carotid artery atherosclerosis in the Insulin Resistance Atherosclerosis Study. Liese AD, Nichols M, Hodo D, Mellen PB, Schulz M, Goff DC, D'Agostino RB. Br J Nutr. 2010 May;103(10):1471-9. Epub 2010 Jan 22.	2010	We aimed to identify food intake patterns that operate via haemostatic and inflammatory pathways on progression of atherosclerosis among 802 middle-aged adults with baseline and 5-year follow-up ultrasound measurements of common (CCA) and internal carotid artery (ICA) intimal medial thickness (IMT). Food intake was ascertained with an FFQ. We derived food patterns using reduced rank regression (RRR) with plasminogen activator inhibitor 1 and fibrinogen as response variables. We explored the impact of various food pattern simplification approaches. We identified a food pattern characterised by higher intakes of less healthful foods (low-fibre bread and cereal, red and processed meat, cottage cheese, tomato foods, regular soft drinks and sweetened beverages) and lower intakes of more healthful foods (wine, rice and pasta, meal replacements and poultry). The pattern was positively associated with mean CCA IMT at follow-up (P = 0.0032), a 1 sd increase corresponding to an increase of 13 mum higher CCA IMT at follow-up, adjusted for demographic and cardiovascular risk factors. With increasing pattern quartile (Q), the percentage change in CCA IMT increased significantly: Q1 0.8 %; Q2 3.2 %; Q3 8.6 %; Q4 7.9 % (P = 0.0045). No clear association with ICA IMT was observed. All simplification methods yielded similar results. The present results support the contention that a pro-inflammatory and pro-thrombotic dietary pattern increases the rate of	PC	(+)				Tomato considered part of "poor" diet.

				coronary artery atherosclerosis progression, independent of traditional cardiovascular risk factors. RRR is a promising and robust tool for moving beyond the previous focus on nutrients or foods into research on the health effects of broader dietary patterns.						
Heart: inflammation	Watzl B	Supplementation of a low-carotenoid diet with tomato or carrot juice modulates immune functions in healthy men. Watzl B, Bub A, Briviba K, Rechkemmer G. Ann Nutr Metab. 2003;47(6):255-61.	2003	BACKGROUND: Beta-carotene has been shown to enhance immune functions in humans. Whether vegetables rich in carotenoids, such as beta-carotene or lycopene, modulate immune functions in healthy humans is presently not known. The objective of this study was to investigate the effects of a low-carotenoid diet supplemented with either tomato (providing high amounts of lycopene) or carrot juice (providing high amounts of alpha- and beta-carotene) on immune functions in healthy men. METHOD: In a blinded, randomized, cross-over study, male subjects on a low-carotenoid diet consumed 330 ml/day of either tomato juice (37.0 mg/day lycopene) or carrot juice (27.1 mg/day beta-carotene and 13.1 mg/day alpha-carotene) for 2 weeks with a 2-week depletion period after juice intervention. Immune status was assessed by measuring lytic activity of natural killer (NK) cells, secretion of cytokines (IL-2, IL-4, TNFalpha), and proliferation by activated peripheral blood mononuclear cells. RESULTS: Juice consumption resulted in relatively fast responses in plasma carotenoid concentrations ($p < 0.0002$) which were not accompanied by concomitant changes in immune functions. For IL-2, NK cell cytotoxicity,	RCT		N			

				and lymphocyte proliferation, maximum responses were observed during depletion periods. The highest production rate was measured only for TNFalpha at the end of the first intervention period. Juice intervention did not modulate the secretion of IL-4. CONCLUSIONS: Increased plasma carotenoid concentrations after vegetable juice consumption are accompanied by a time-delayed modulation of immune functions in healthy men consuming a low-carotenoid diet.						
Heart: inflammation, endothelial	Blum A	Tomato-rich (Mediterranean) diet does not modify inflammatory markers. Blum A, Monir M, Khazim K, Peleg A, Blum N. Clin Invest Med. 2007;30(2):E70-4.	2007	BACKGROUND: The Mediterranean diet is rich in lycopene and has been reported to reduce cardiovascular events. The mechanism of prevention of cardiovascular events has not been clearly established. Our aim was to study the effects of a tomatoes-rich diet on markers of vascular inflammation. METHODS: Plasma concentrations of E-selectin, intercellular adhesion molecule 1 (ICAM-1), and high sensitivity C-reactive protein (hs-CRP) were determined by ELISA in 103 apparently healthy volunteers. Volunteers were randomly assigned to two groups: 50 participants ate 300 g tomatoes daily for 1 month, and 53 participants ate their usual diet with tomatoes prohibited during that period. Markers of inflammation were measured before enrollment and 1 month after their assigned diet. RESULTS: The two diet groups had similar baseline clinical characteristics and similar baseline levels of inflammatory markers. After 30 days of assigned diet	RCT	N				CRP E-selectin ICAM

				concentrations of hs-CRP, E-selectin and ICAM-1 were unchanged compared with baseline in the tomato-rich diet. However, ICAM-1 concentration was increased in the regular diet group from 247.55+/-55 ng/ml to 264.71+/-60.42 ng/ml (P=0.01). CONCLUSIONS: The mechanisms of benefit of the tomato-rich diet are not directly related to inhibition of markers of vascular inflammation						
Heart: lipids	Sakamoto H	Elevation of serum carotenoids after continual ingestion of tomato juice. Sakamoto H, Mori H, Ojima F, Ishiguro Y, Arimoto S, Imae Y, Ogawa NT, and Fukuba H J Jpn Soc Nutr Food Sci, 47 (1994), pp. 93–99.	1994	The concentrations of lycopene and β-carotene in human serum were measured before and after continual ingestion of tomato juice. The change in the level of cholesterol during this period was investigated simultaneously. Sixty-five female students were divided into 4 groups. They ingested either 1, 2 or 3 cans of tomato juice per day and the control group received a can of apple juice per day for 4 weeks. The lycopene level in serum showed a significant increase following the ingestion of tomato juice. In the case of subjects ingesting 2 or 3 cans daily, the level in serum increased to over three times the level of serum lycopene determined at the start of the experiment. Although the β-carotene content of the tomato juice was about one-thirtieth that of lycopene, the β-carotene level in serum was about double in the sublects who ingested 3 cans daily. These results suggest that continual ingestion of tomato juice is effective for raising the serum levels of lycopene and β-carotene. Although most of the lycop ne in the tamato juice was the all-trans type, a large amount of the cis-isomer was detected in the serum of the subjects after tomato juice ingestion. This would be due mainly to the	RCT		N Lipids			Dose response

				isomerization reaction in the body. No significant changes in the levels of serum lipids, such as LDL-cholesterol, were observed. This suggests that the increase in the level of carotenoid in serum by ingesting tomato juice dose not induce an increase in the level of serum lipid.						
Heart: lipids	Blum A	Effects of tomatoes on the lipid profile. Blum A, Merei M, Karem A, Blum N, Ben-Arzi S, Wirsansky I, Khazim K. Clin Invest Med. 2006 Oct;29(5):298-300.	2006	PURPOSE: The Mediterranean diet has been reported to reduce cardiovascular mortality and morbidity considerably. Tomatoes and lycopene are considered potent antioxidants. Our purpose was to study the effects of a tomatoe-rich diet on the lipid profile following 300g daily of tomatoes for one month. METHODS: Plasma concentrations of triglyceride, total cholesterol, HDL-cholesterol, LDL-cholesterol and VLDL-cholesterol were determined in 98 apparently healthy volunteers (mean age 45.5+/-14.1 yr) before and after one month of follow-up. Fifty volunteers (34 women and 16 men) ate tomatoes 300g daily and 48 volunteers (32 women and 16 men) continued their regular diet without eating tomatoes for a month. RESULTS: In the regular diet group, there were no changes in the lipid profile: triglyceride level (169.6+/-156.8 vs. 147.6+/-93.4mg/dl; P=0.33), total cholesterol level (198.3+/-41.2mg/dl vs. 204.2+/-70.9mg/dl; P=0.23), HDL-cholesterol level (50.6+/-12.2mg/dl vs. 47.6+/-10.8mg/dl; P=0.79), and LDL-cholesterol level (122.7+/-39.4mg/dl vs. 120.2+/-32.2mg/dl; P=0.24) before and after the 1 month offollow-up. In the tomato-rich diet group: triglyceride level 170.8+/-85.4mg/dl to 167.4+/-99.4mg/ dl (P=0.98), total cholesterol level 207.5+/-44.3mg/ dl to 204.1+/-45.1mg/dl	Interv	(+) HDL				Only HDL ↑ with tomato diet

				(P=0.68), HDL-cholesterol level 46.1+/-10.6mg/dl to 53.4+/-13.3mg/dl (P=0.03), and LDL-cholesterol level 127.7+/-41.8mg/dl to 119.1+/-41.7mg/dl (P=0.57). CONCLUSION: We found that tomatoes'-rich diet (300g daily for one month) increased HDL-cholesterol level significantly by 15.2%.						
Heart: lipids and oxidation	Agarwal S	Tomato lycopene and low density lipoprotein oxidation: a human dietary intervention study. Agarwal S, Rao AV. Lipids. 1998 Oct;33(10):981-4.	1998	Increase in low density lipoprotein (LDL) oxidation is hypothesized to be causally associated with increasing risk of atherosclerosis and coronary heart disease. In recent epidemiological studies, tissue and serum levels of lycopene, a carotenoid available from tomatoes, have been found to be inversely related to risk of coronary heart disease. A study was undertaken to investigate the effect of dietary supplementation of lycopene on LDL oxidation in 19 healthy human subjects. Dietary lycopene was provided using tomato juice, spaghetti sauce, and tomato oleoresin for a period of 1 wk each. Blood samples were collected at the end of each treatment. Serum lycopene was extracted and measured by high-performance liquid chromatography using an absorbance detector. Serum LDL was isolated by precipitation with buffered heparin, and thiobarbituric acid-reactive substances (TBARS) and conjugated dienes (CD) were measured to estimate LDL oxidation. Both methods, to measure LDL oxidation LDL-TBARS and LDL-CD, were in good agreement with each other. Dietary supplementation of lycopene significantly increased serum lycopene levels by at least twofold. Although there was no change in serum cholesterol levels (total, LDL, or high-density lipoprotein), serum lipid peroxidation and LDL oxidation were significantly decreased. These results may have	Interv		N Lipids ~~~~~ (-) Oxidation		N Lipids ~~~~~ (-) Oxidation	Tom J Spaghetti sauce Tom Oleoresin extract LDLox TBARS Lipids

				relevance for decreasing the risk for coronary heart disease.						
Heart: lipids and oxidation	Collins JK	Lycopene from two food sources does not affect antioxidant or cholesterol status of middle-aged adults. Collins JK, Arjmandi BH, Claypool PL, Perkins-Veazie P, Baker RA, Clevidence BA. Nutr J. 2004 Sep 15;3:15.	2004	BACKGROUND: Epidemiological studies have reported associations between reduced cardiovascular disease and diets rich in tomato and/or lycopene. Intervention studies have shown that lycopene-containing foods may reduce cholesterol levels and lipid peroxidation, factors implicated in the initiation of cardiovascular disease. The objective of this study was to determine whether consumption of lycopene rich foods conferred cardiovascular protection to middle-aged adults as indicated by plasma lipid concentrations and measures of ex vivo antioxidants. METHODS: Ten healthy men and women consumed a low lycopene diet with no added lycopene (control treatment) or supplemented with watermelon or tomato juice each containing 20 mg lycopene. Subjects consumed each treatment for three weeks in a crossover design. Plasma, collected weekly was analyzed for total cholesterol, high density lipoprotein cholesterol (HDL-C) and triglyceride concentrations and for the antioxidant biomarkers of malondialdehyde formation products (MDA), plasma glutathione peroxidase (GPX) and ferric reducing ability of plasma (FRAP). Data were analyzed using Proc Mixed Procedure and associations between antioxidant and lipid measures were identified by Pearson's product moment correlation analysis. RESULTS: Compared to the control diet, the lycopene-containing foods did not affect plasma lipid concentrations or antioxidant biomarkers. Women had higher total cholesterol, HDL-C and triglyceride	RCT		N			Lipids MDA GPX FRAP

				concentrations than did the men. Total cholesterol was positively correlated to MDA and FRAP while HDL-C was positively correlated to MDA and GPX. GPX was negatively correlated to triglyceride concentration. CONCLUSIONS: The inclusion of watermelon or tomato juice containing 20 mg lycopene did not affect plasma lipid concentrations or antioxidant status of healthy subjects. However, plasma cholesterol levels impacted the results of MDA and FRAP antioxidant tests.						
Heart: lipids and oxidation	Madrid AE	[Short-term Lycopersicum esculentum consumption may increase plasma high density lipoproteins and decrease oxidative stress]. [Article in Spanish] Madrid A E, Vásquez Z D, Leyton A F, Mandiola C, Escobar F JA. Rev Med Chil. 2006 Jul;134(7):855-62. Epub 2006 Aug 29.	2006	BACKGROUND: Tomato has a high antioxidant capacity due to its high content of vitamin C, vitamin E and lycopene that is a powerful free radical scavenger. However, the effects of tomato on plasma lipoproteins is not well known, and there is little evidence about the relationship between tomato consumption and oxidative state changes in humans. AIM: To assess in vivo the effects of dietary supplementation with pure concentrated tomato juice on short term changes in oxidative state and plasma lipoproteins in healthy volunteers. SUBJECTS AND METHODS: Seventeen healthy volunteers were studied. They received a supplement of pure tomato juice during 7 days. At baseline, at the end of the supplementarion period and eight days after the end of the supplementation, a blood sample was drawn to measure total antioxidant capacity (TRAP), enzymatic antioxidants (catalase and superoxide dismutase), non-enzimatic	Interv		N Oxidation ~~~~~ (-) HDL			

				antioxidants (lycopene and a-tocopherol) and plasma lipoproteins. RESULTS: Lycopene level increased early and significantly in comparison with basal levels (48%; p < 0.05). TRAP, catalase and superoxide dismutase did not change significantly. HDL cholesterol increased significantly in 5.6+/-4.3 mg/dL (p < 0.002) on the second sampling period, improving the ratio cholesterol/HDL. It returned to baseline in the third period. CONCLUSIONS: Dietary supplementation of concentrated tomato juice significantly increases lycopene levels and HDL cholesterol. Non significant changes observed in TRAP, catalase and superoxide dismutase were observed during the supplementation period.						
Heart: lipids and oxidation	Bose KS	Effect of lycopene from cooked tomatoes on serum antioxidant enzymes, lipid peroxidation rate and lipid profile in coronary heart disease. Bose KS, Agrawal BK. Singapore Med J. 2007 May;48(5):415-20.	2007	INTRODUCTION: This present study aims to evaluate the beneficial effect of tomatoes, a rich source of lycopene, which is a relatively new carotenoid known to play an important role in human health and disease. METHODS: We investigated the lipid peroxidation rate by estimating malondialdehyde (MDA), levels of serum enzymes involved in antioxidant activities such as superoxide dismutase, glutathione peroxidase, glutathione reductase, reduced glutathione and lipid profile, which includes total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein and very low density lipoprotein in a coronary heart disease (CHD) group and an age-matched control group. RESULTS: We observed significantly lower	Interv				N Lipid ~~~~~ (-) Oxidation	

				levels of serum antioxidant enzymes and very high lipid peroxidation rate in the CHD group, when compared to the controls (p-value is less than 0.001). At the same time, we observed significantly higher levels of lipids in the CHD group, when compared to the controls (p-value is less than 0.001). 60 days of tomato supplementation in the CHD group showed a significant improvement in the levels of serum enzymes involved in antioxidant activities and decreased lipid peroxidation rate (p-value is less than 0.001), but there were no significant changes in lipid profile (p-value is greater than 0.10). CONCLUSION: These findings suggest that tomato lycopene may have considerable therapeutic potential as an antioxidant but may not be used as a hypolipidaemic agent in CHD.						
Heart: lipids and oxidation	Shen YC	Contribution of tomato phenolics to antioxidation and down-regulation of blood lipids. Shen YC, Chen SL, Wang CK. J Agric Food Chem. 2007 Aug 8;55(16):6475-81. Epub 2007 Jul 13.	2007	This study was performed to understand the characteristics and biological activities of phenolics in tomatoes and to examine the effect of tomato on the regulation of blood lipids. Tomatoes of both big and small sizes were used fresh, after blanching, or after blanching and heating. Moreover, a human clinical trial was conducted to examine plasma antioxidation, status of blood lipids, and phenolic responses after ingestion of fresh tomato, tomato juice, and a lycopene drink. The contents of tomato phenolics were increased by 34% for small tomato and by 23% for big tomato after treatment by blanching and heating at 100 degrees C for 30 min. Tomato phenolics showed fair antioxidant activity (57-71%) and also synergistically promoted the antioxidation (81-100%) of tomato carotenoids. In the human clinical study, total antioxidant capacity and phenolic	RCT		(-) Lipid oxidation	(-) Lipid oxidation	N	

				contents in plasma were increased after administration of fresh tomato and tomato juice, but no significant difference was found for lycopene drink consumption. Triglyceride levels and low-density lipoprotein cholesterol were decreased after administration of fresh tomato and tomato juice, and high-density lipoprotein cholesterol was increased.						
Heart: lipids and oxidation	Silaste ML	Tomato juice decreases LDL cholesterol levels and increases LDL resistance to oxidation. Silaste ML, Alfthan G, Aro A, Kesäniemi YA, Hörkkö S. Br J Nutr. 2007 Dec;98(6):1251-8. Epub 2007 Jul 9.	2007	High dietary intakes of tomato products are often associated with a reduced risk of CVD, but the atheroprotective mechanisms have not been established. This study was conducted to investigate the effects of increased dietary intake of tomato products on plasma lipids and LDL oxidation. The diet intervention included a baseline period, a 3-week low tomato diet (no tomato products allowed) and a 3-week high tomato diet (400 ml tomato juice and 30 mg tomato ketchup daily). Twenty-one healthy study subjects participated in the study. Total cholesterol concentration was reduced by 5.9 (sd 10) % (P = 0.002) and LDL cholesterol concentration by 12.9 (sd 17.0) % (P = 0.0002) with the high tomato diet compared to the low tomato diet. The changes in total and LDL cholesterol concentrations correlated significantly with the changes in serum lycopene (r 0.56, P = 0.009; r 0.60, P = 0.004, total and LDL, respectively), beta-carotene (r 0.58, P = 0.005; r 0.70, P < 0.001) and gamma-carotene concentrations (r 0.64, P = 0.002; r 0.64, P = 0.002). The level of circulating LDL to resist formation of oxidized phospholipids increased 13 % (P = 0.02) in response to the high tomato diet. In conclusion, a high dietary intake of tomato products had atheroprotective effects, it significantly reduced LDL cholesterol levels, and	RCT		(-) ↓TC, LDL ~~~~~ (-) OxLDL			

				increased LDL resistance to oxidation in healthy normocholesterolaemic adults. These atheroprotective features associated with changes in serum lycopene, beta-carotene and gamma-carotene levels.						
Heart: lipids and oxidation	Talvas J	Differential effects of lycopene consumed in tomato paste and lycopene in the form of a purified extract on target genes of cancer prostatic cells. Talvas J, Caris-Veyrat C, Guy L, Rambeau M, Lyan B, Minet-Quinard R, Lobaccaro JM, Vasson MP, Georgé S, Mazur A, Rock E. Am J Clin Nutr. 2010 Jun;91(6):1716-24. Epub 2010 Apr 14	2010	BACKGROUND: Prospective studies indicate that tomato consumers are protected against prostate cancer. Lycopene has been hypothesized to be responsible for tomato health benefits. OBJECTIVE: Our aim was to differentiate the effects of tomato matrix from those of lycopene by using lycopene-rich red tomatoes, lycopene-free yellow tomatoes, and purified lycopene. DESIGN: Thirty healthy men (aged 50-70 y old) were randomly assigned to 2 groups after a 2-wk washout period. In a crossover design, each group consumed yellow and red tomato paste (200 g/d, which provided 0 and 16 mg lycopene, respectively) as part of their regular diet for 1 wk separated by 2 wk of washout. Then, in a parallel design, the first group underwent supplementation with purified lycopene (16 mg/d) for 1 wk, whereas the second group received a placebo. Sera collected before and after the interventions were incubated with lymph node cancer prostate cells to measure the expression of 45 target genes. RESULTS: Circulating lycopene concentration increased only after consumption of red tomato paste and purified lycopene. Lipid profile, antioxidant status, prostate-specific antigen, and insulin-like growth factor I were not modified by consumption of tomato pastes and lycopene. We	RCT		N Lipids Ox status PSA IGF-1		N Lipids Ox status PSA IGF-1	

				observed significant up-regulation of IGFBP-3 and Bax:Bcl-2 ratio and down-regulation of cyclin-D1, p53, and Nrf-2 after cell incubation with sera from men who consumed red tomato paste when compared with sera collected after the first washout period, with intermediate values for yellow tomato paste consumption. Cell incubation with sera from men who consumed purified lycopene led to significant up-regulation of IGFBP-3, c-fos, and uPAR compared with sera collected after placebo consumption. CONCLUSION: Dietary lycopene can affect gene expression whether or not it is included in its food matrix. This trial was registered by the French Health Ministry at http://www.sante-sports.gouv.fr as 2006-A00396-45.						
Heart: MI	Gallus S	Pizza and risk of acute myocardial infarction. Gallus S, Tavani A, La Vecchia C. Eur J Clin Nutr. 2004 Nov;58(11):1543-6.	2004	OBJECTIVES: Pizza eating has been favourably related to the risk of cardiovascular disease, but the data are limited. To evaluate the potential role of pizza consumption on the risk of acute myocardial infarction (AMI), we considered data from an Italian study. DESIGN: We conducted a hospital-based case-control study on 507 cases of nonfatal AMI and 478 controls in Milan, Italy, between 1995 and 1999. RESULTS: The multivariate odds ratios were 0.78 for occasional, 0.62 for regular and 0.44 for frequent eaters. The estimates were similar across strata of age, sex, smoking and other major covariates. CONCLUSIONS: Some of the ingredients of pizza have been shown to have a favourable influence on the risk of	CC		(-)			(-)pizza

				cardiovascular disease. However, there is no single explanation for the present findings. Pizza may in fact represent a general indicator of Italian diet, that has been shown to have potential cardiovascular benefits.						
Heart: MI	Lockhart MS	Dietary patterns, food groups and myocardial infarction: a case-control study. Lockheart MS, Stefen LM, Rebnord HM, Fimreite RL, Ringstad J, Thell DS, Pedersen JI, Jacobs DR Jr. Br J Nutr. 2007 Aug: 98(2):380-7. Epub 2007 Mar 29.	2007	Certain dietary patterns may be related to the risk of CVD. We hypothesised that a plant-centred dietary pattern would be associated with a reduced risk of first myocardial infarction (MI). A case-control study of Norwegian men and postmenopausal women (age 45-75 years) was performed. A FFQ was administered, generally within 3 d after incident MI (n 106 cases). Controls (n 105) were frequency matched on sex, age and geographic location. On the FFQ, 190 items were categorised into thirty-five food groups and an a priori healthy diet pattern score was created. We estimated OR using logistic regression with adjustment for energy intake, family history of heart disease, marital status, current smoking, education and age. Among food groups, the risk of MI was significantly higher per SD of butter and margarine (OR 1.66 (95 % CI 1.12, 2.46)), and lower per SD of tomatoes (OR 0.53 (95 % CI 0.35, 0.79)), high-fat fish (OR 0.57 (95 % CI 0.38, 0.86)), wine (OR 0.58 (95 % CI 0.41, 0.83)), salad (OR 0.59 (95 % CI 0.40, 0.87)), whole grain breakfast cereals (OR 0.64 (95 % CI 0.45, 0.90)), cruciferous vegetables (OR 0.66 (95 % CI 0.47, 0.93)) and non-hydrogenated vegetable oil (OR 0.68 (95 % CI 0.49, 0.95)). An abundance of cases were found to have a low a priori healthy diet pattern score. A dietary pattern emphasising nutrient-rich plant foods and high-fat fish and low in trans fatty acids was associated	CC	(-)				

				with decreased risk of MI among Norwegians.						
Heart: MI and Stroke	Sesso HD	Dietary lycopene, tomato-based food products and cardiovascular disease in women. Sesso HD, Liu S, Gaziano JM, Buring JE. J Nutr. 2003 Jul;133(7):2336-41.	2003	In addition to the inverse association of dietary lycopene with various cancers, studies suggest a role for lycopene in cardiovascular disease (CVD) prevention. We determined whether the intake of lycopene or tomato-based foods is associated with the risk of CVD in a prospective cohort of 39,876 middle-aged and older women initially free of CVD and cancer. Participants completed a food-frequency questionnaire and provided self-reports of coronary risk factors. Dietary lycopene levels were divided into quintiles, and primary lycopene food sources (total tomato-based products, including tomatoes, tomato juice, tomato sauce and pizza) were categorized. During 7.2 y of follow-up, 719 CVD cases (including myocardial infarction, stroke, revascularization and CVD death) occurred. Compared with women in the 1st quintile of lycopene, those in increasing quintiles had multivariate relative risks (RR) of CVD of 1.11, 1.14, 1.15 and 0.90 (P for trend = 0.34). For the consumption of tomato-based products, women consuming 1.5 to <4, 4 to <7, 7 to <10 and >or=10 servings/wk had RR (95% CI) of CVD of 1.02 (0.82-1.26), 1.04 (0.82-1.31), 0.68 (0.49-0.96) and 0.71 (0.42-1.17) (P for trend = 0.029) compared with women consuming <1.5 servings/wk. Among lycopene food sources, those in the highest levels of tomato sauce (>or=2 servings/wk) and pizza intake (>or=2 servings/wk), with multivariate RR of 0.76 (0.55-1.05) and 0.66 (0.37-1.18), respectively, had potential reductions in CVD risk. Dietary lycopene was not strongly associated with the risk of CVD. However, the possible inverse	PC	(-)	(-)		N	

				associations noted for higher levels of tomato-based products, particularly tomato sauce and pizza, with CVD suggest that dietary lycopene or other phytochemicals consumed as oil-based tomato products confer cardiovascular benefits.						
Heart: oxidation	Parfitt VJ	A comparison of antioxidant status and free radical peroxidation of plasma lipoproteins in healthy young persons from Naples and Bristol. Parfitt VJ, Rubba P, Bolton C, Marotta G, Hartog M, Mancini M. Eur Heart J. 1994 Jul;15(7):871-6.	1994	Ischaemic heart disease mortality is much lower in Southern Italy than in the U.K. and this is not entirely explained by differences in classical risk factors. Differences in antioxidant intake, affecting free radical peroxidation of plasma lipoproteins, may be relevant. Therefore, dietary intake, antioxidant status and plasma lipid peroxidation were compared in healthy young persons eating typical regional diets from Naples (22) and Bristol (26). The Naples group consumed more fresh tomatoes, more fat as monounsaturates (from olive oil) and had higher plasma levels of the lipid antioxidants vitamin E (mean (SD; 95% CI) 29.1 (4.5; 26.8 to 31.3) vs 25.1 (3.86; 23.4 to 26.8) mumol.l-1, P = 0.005) and beta-carotene (4.74 (1.2; 4.14 to 5.34) vs 2.85 (0.8; 2.5 to 3.2) mumol.l-1, P < 0.001). Intakes of vitamin C, total uncooked fruit and vegetables, plasma vitamin A, serum selenium and copper levels were similar. All indices of plasma lipid peroxidation were significantly lower in the Naples group: conjugated dienes (median (interquartile range; non-parametric 95% CI)) 29 (21.5-39.9; 24 to 36.7) vs 41.5 (37-48.5; 38 to 44.5) mumol.l-1, P < 0.001; diene conjugation index 1.38 (1.02-1.55; 1.06 to 1.49) x 10(-2) vs 1.57 (1.43-1.74; 1.44 to 1.71) x 10(-2), P = 0.019; lipid peroxides (geometric mean (95% CI) 1.24 (1.12 to 1.37) vs 4.58 (3.84 to 5.46) mumol.l-1, P < 0.001.	CS			(-)		Diet pattern Lipid ox

Heart: oxidation	Mancini M	Antioxidants in the Mediterranean diet. Mancini M, Parfitt VJ, Rubba P. Can J Cardiol. 1995 Oct;11 Suppl G:105G-109G	1995	It has been suggested that antioxidant vitamins or other antioxidants might inhibit the oxidation of low density lipoproteins into a particularly atherogenic form and preserve endothelial function. Antioxidants in the Mediterranean diet have been evaluated in relation to cardiovascular disease protection in this area. Observational epidemiologic data obtained from case-control, cohort or cross-cultural studies have consistently suggested that persons, such as those living in the Mediterranean area, who consume large amounts of antioxidant vitamins have a lower than average risk of cardiovascular disease. In another cross-cultural comparison, dietary intake, antioxidant status and plasma lipid peroxidation were compared in healthy young persons in Naples (Southern Italy) who consumed typical regional foods, and in Bristol (UK). The Naples group consumed more tomatoes and tomato juice, a higher proportion of monounsaturated fatty acids (from olive oil) and had a higher level of lipid antioxidant vitamin E (P = 0.005) and of beta carotene (P < 0.001) than the Bristol group. The intake of vitamin C, fresh fruit and vegetables, plasma vitamin A, serum selenium and copper levels did not differ. Several indices of plasma lipid peroxidation were significantly lower in the Naples group: conjugated dienes (P < 0.001), diene conjugation index (P = 0.019), lipid peroxides (P < 0.001). Dietary habits leading to relatively low levels of oxidized lipoproteins might contribute to the lower risk of coronary artery disease in Southern Italy.	CS	(-)				LDL ox Lipid perox Diet pattern
Heart: oxidation	Pool-Zobel BL	Consumption of vegetables reduces genetic damage in	1997	A human intervention study with vegetable products has been performed in twenty three healthy, non smoking males aged 27-40. It was the	Interv		(-)			

		humans: first results of a human intervention trial with carotenoid-rich foods. Pool-Zobel BL, Bub A, Müller H, Wollowski I, Rechkemmer G. Carcinogenesis. 1997 Sep;18(9):1847-50.		aim of the study to assess whether consumption of vegetables containing different carotenoids could protect against DNA damage and oxidative DNA damage. The subjects consumed their normal diets, but abstained from vegetables high in carotenoids throughout the study period. After a 2 week depletion period, they received daily 330 ml tomato juice with 40 mg lycopene (weeks 3 and 4), 330 ml carrot juice with 22.3 mg beta-carotene and 15.7 mg alpha-carotene (weeks 5 and 6), and 10 g dried spinach powder (in water or milk) with 11.3 mg lutein (weeks 7 and 8). Blood was collected weekly and DNA damage was detected in peripheral blood lymphocytes with the 'COMET' assay. Oxidised DNA bases were detected by including an incubation step with endonuclease III. The supplementation of the diet with tomato, carrot or spinach products resulted in a significant decrease in endogenous levels of strand breaks in lymphocyte DNA. Oxidative base damage was significantly reduced during the carrot juice intervention. These findings support the hypothesis that carotenoid containing plant products exert a cancer-protective effect via a decrease in oxidative and other damage to DNA in humans.						
Heart: oxidation	Dugas TR	Dietary supplementation with beta-carotene, but not with lycopene, inhibits endothelial cell-mediated oxidation of low-density lipoprot ein. Dugas TR, Morel	1999	Carotenoids may protect low-density lipoprotein from oxidation, a process implicated in the development of atherosclerosis. Our previous studies showed that in vitro enrichment of low-density lipoprotein (LDL) with beta-carotene protected it from cell-mediated oxidation. However, in vitro enrichment with either lutein or lycopene actually enhanced oxidation of the LDL. In the present studies we have examined the impact of LDL	Interv		N			LDL ox

		DW, Harrison EH. Free Radic Biol Med. 1999 May;26(9-10):1238-44		carotenoid content on its oxidation by human aortic endothelial cells (EaHy-1) in culture, comparing the effects of in vivo supplementation with in vitro enrichments. The beta-carotene content in human LDL was increased three- to sixfold by daily supplementation with 15 mg beta-carotene for 4 weeks, and the lycopene content of LDL in other individuals was increased two- to threefold by ingestion of one glass (12 ounce) of tomato juice daily for 3 weeks. LDL isolated from these healthy, normolipidemic donors not taking supplemental carotenoid was incubated at 0.25 mg protein/ml with EaHy-1 cells in Ham's F-10 medium for up to 48 h. Following dietary beta-carotene supplementation, LDL oxidation (as assessed by formation of lipid hydroperoxides) was markedly inhibited, to an even greater extent than was observed for LDL enriched in vitro with beta-carotene (that resulted in an 11- to 12-fold increase in LDL beta-carotene). No effect on cell-mediated oxidation was observed, however, for LDL enriched in vivo with lycopene. Thus, beta-carotene appears to function as an antioxidant in protecting LDL from cell-mediated oxidation although lycopene does not. The fact that the three- to sixfold enrichments of LDL with beta-carotene achieved by dietary supplementation were more effective in inhibiting oxidation than the 11- to 12-fold enrichments achieved by an in vitro method suggests that dietary supplementation is a more appropriate procedure for studies involving the enrichment of lipoprotein with carotenoids.						
Heart: oxidation	Rehman A	Tomato consumption modulates	1999	Consumption of a single serving of tomatoes by healthy human volunteers was sufficient to alter levels of oxidative	Interv	(-)/N				DNA ox

		oxidative DNA damage in humans. Rehman A, Bourne LC, Halliwell B, Rice-Evans CA. Biochem Biophys Res Commun. 1999 Sep 7;262(3):828-31.		DNA base damage in white cell DNA within 24 h. Levels of the mutagenic oxidized purine base 8-hydroxyguanine decreased, especially in those subjects whose initial levels of this base were higher than the mean. However, total DNA base damage remained unchanged since levels of 8-hydroxyadenine rose. The ability of tomato consumption to modulate oxidative DNA damage in the short term may indicate why daily consumption of fruits and vegetables is beneficial in decreasing cancer incidence.						
Heart: oxidation	Riso P	Does tomato consumption effectively increase the resistance of lymphocyte DNA to oxidative damage? Riso P, Pinder A, Santangelo A, Porrini M. Am J Clin Nutr. 1999 Apr;69(4):712-8.	1999	BACKGROUND: Lycopene, the main carotenoid in tomato, has been shown to be a potent antioxidant in vitro. However, there is no significant evidence of its antioxidant action in vivo. OBJECTIVE: We evaluated the effect of tomato intake on plasma carotenoid concentrations and lymphocyte resistance to oxidative stress. DESIGN: Ten healthy women (divided into 2 groups of 5 subjects each) ate a diet containing tomato puree (providing 16.5 mg lycopene) and a tomato-free diet for 21 d each in a crossover design. Before and after each diet period, plasma carotenoid concentrations and primary lymphocyte resistance to oxidative stress (evaluated by means of single-cell gel electrophoresis) were analyzed. RESULTS: After the first 21-d experimental period, total plasma lycopene concentrations increased by 0.5 micromol/L (95% CI: 0.14, 0.87) in the group that consumed the tomato diet and decreased by 0.2 micromol/L (95%	RCT		(-)			DNA ox

				CI: -0.11, -0.30) in the group that consumed the tomato-free diet (P < 0.001). Tomato consumption also had an effect on cellular antioxidant capacity: lymphocyte DNA damage after ex vivo treatment with hydrogen peroxide decreased by 33% (95% CI: 0.8%, 61%; P < 0.05) and by 42% (95% CI: 5.1%, 78%; P < 0.05) in the 2 groups of subjects after consumption of the tomato diet. CONCLUSION: The consumption of tomato products may reduce the susceptibility of lymphocyte DNA to oxidative damage						
Heart: oxidation	Steinberg FM	Antioxidant vitamin supplementation and lipid peroxidation in smokers. Steinberg FM, Chait A. Am J Clin Nutr. 1999 Jun;69(6):1292.	1999	Previous studies have shown that cigarette smoke enhances lipid peroxidation. This study examined the effect of daily consumption of a tomato-based juice supplemented with vitamin C (600 mg), vitamin E (400 IU, or 400 mg), and beta-carotene (30 mg) on various indexes of lipid peroxidation (breath pentane excretion and susceptibility of LDL to copper-mediated oxidation) in smokers. In addition, plasma lycopene and vitamin concentrations and total peroxyl radical trapping potential, a measure of antioxidant defenses, were assessed. Relative to the placebo juice, the vitamin-supplemented juice resulted in a significant decrease in breath-pentane excretion as well as a significant improvement in the resistance of LDL to oxidation. The lag phase of conjugated diene formation lengthened and the propagation rate decreased, indicating a decreased susceptibility of LDL to oxidative modification. Increased concentrations of plasma vitamin C, beta-carotene, and lycopene were found to be significantly correlated with the conjugated diene lag phase and rate of formation. Vitamin E was highly	RCT		(-)/N			LDL ox

				correlated with beta-carotene. Plasma total peroxyl radical trapping potential values did not change in response to supplementation. This study thus indicates that an antioxidant-supplemented drink can reduce lipid peroxidation and susceptibility of LDL to oxidation in smokers and may ameliorate the oxidative stress of cigarette smoke.						
Heart: oxidation	Sutherland WH	Supplementation with tomato juice increases plasma lycopene but does not alter susceptibility to oxidation of low-density lipoproteins from renal transplant recipients. Sutherland WH, Walker RJ, De Jong SA, Upritchard JE. Clin Nephrol. 1999 Jul;52(1):30-6	1999	AIM: Oxidative stress and susceptibility of low-density lipoproteins (LDL) to oxidation are increased in renal transplant recipients. The aim of this study was to determine the effect of dietary supplementation with tomato juice on plasma levels of the antioxidant lycopene, serum indices of lipid peroxidation (fluorescent lipid oxidation products (FLOP) and thiobarbituric acid-reacting substances (TBARS)) and the resistance of isolated low-density lipoprotein (LDL) to oxidation (lag time) in patients with a kidney graft. SUBJECTS AND METHODS: Fifteen patients were randomized to daily consumption of either tomato juice or synthetic orange drink for 4 weeks in a crossover study. Plasma lycopene levels were significantly higher (1.57 micromol/l versus 0.91 micromol/l, p = 0.015) while serum FLOP and TBARS and resistance of LDL to oxidation were not significantly different during supplementation with tomato juice compared with orange drink. At baseline, serum levels of lycopene and FLOP were abnormally high and serum FLOP was correlated significantly with plasma cyclosporine levels (r = 0.646, p = 0.016).	Interv		N			LDL Ox Lipid perox

				CONCLUSION: In conclusion, these data suggest that increased oxidative stress and susceptibility of LDL to oxidation may not be reduced by increasing plasma lycopene levels with regular consumption of tomato juice in renal transplant recipients.						
Heart: oxidation	Bub A	Moderate intervention with carotenoid-rich vegetable products reduces lipid peroxidation in men. Bub A, Watzl B, Abrahamse L, Delincee H, Adam S, Wever J, Muller H, Rechkemmer G. J Nutr. 2000 Sep;130(9):2200-6.	2000	Because of their antioxidant properties, carotenoids may have beneficial effects in preventing cancer and cardiovascular disease. However, in humans consuming carotenoid-rich vegetables, data concerning the antioxidant effects of carotenoids are rather scarce. A human intervention trial was conducted, therefore, to determine whether a moderately increased consumption of carotenoid-rich vegetables would influence the antioxidant status in 23 healthy men. This short-term feeding study lasted 8 wk during which the men consumed a low carotenoid diet. A 2-wk low carotenoid period was followed by daily consumption of 330 mL tomato juice, then by 330 mL carrot juice and then by 10 g of spinach powder, each for 2 wk. Antioxidant status [water-soluble antioxidants in serum, ferric reducing ability of plasma (FRAP) and antioxidant enzyme activities] and lipid peroxidation (plasma malondialdehyde and ex vivo oxidation of LDL) were determined. In a subgroup of 10 men, lipoprotein carotenoids were measured. The consumption of carotenoid-rich vegetables significantly increased selected carotenoids in lipoproteins but had only minor effects on their relative distribution pattern. Tomato juice consumption reduced plasma thiobarbituric acid reactive substances (TBARS) by 12% (P: < 0.05) and lipoprotein oxidizability in terms of an increased lag time (18%, P: < 0.05).	Interv		(-)			Ox stress Anti-ox status

				Carrot juice and spinach powder had no effect on lipid peroxidation. Water-soluble antioxidants, FRAP, glutathione peroxidase and reductase activities did not change during any study period. In evaluating the low carotenoid diet, we conclude that the additional consumption of carotenoid-rich vegetable products enhanced lipoprotein carotenoid concentrations, but only tomato juice reduced LDL oxidation in healthy men.						
Heart: oxidation	Chopra M	Influence of increased fruit and vegetable intake on plasma and lipoprotein carotenoids and LDL oxidation in smokers and nonsmokers. Chopra M, O'Neill ME, Keogh N, Wortley G, Southon S, Thurnham DI. Clin Chem. 2000 Nov;46(11):1818-29.	2000	BACKGROUND: Epidemiological studies suggest a cardioprotective role for carotenoid-rich foods. Smokers have a high risk of cardiovascular disease and low dietary intake and plasma concentrations of carotenoids. The aim of this study was to determine the carotenoid response of smokers and nonsmokers to increased intake of 300-400 g of vegetables and its effect on LDL oxidation. METHODS: After a depletion period of 8 days, 34 healthy females (18 nonsmokers, 16 smokers) were supplemented with beta-carotene- and lutein-rich (green) and lycopene-rich (red) vegetable foods, each for 7 days. RESULTS: Baseline concentrations (mean +/- SD) of plasma beta-carotene (0.203+/-0.28 micromol/L vs. 0.412+/-0.34 micromol/L; P <0.005) and lutein (0.180 +/-0.10 vs. 0.242+/-0.11 micromol/L; P<0.05) but not lycopene (0.296+/-0.10 vs. 0.319+/-0.33 micromol/L) were significantly lower in smokers compared with nonsmokers. After supplementation, the change (supplementation minus depletion) in plasma beta-carotene (0.152+/- 0.43 vs. 0.363+/-0.29 micromol/L	Interv	(-)/N				(N) Smokers (-) Non-smokers LDL ox

				in smokers vs. nonsmokers; P = 0.002) and LDL lutein (0.015+/-0.03 vs. 0.029+/-0.03 micromol/mmol cholesterol; P = 0.01) was significantly lower in smokers than nonsmokers. Green-vegetable supplementation had no effect on the resistance of LDL to oxidation (lag-phase) in either group. After red-vegetable supplementation, plasma and LDL lycopene concentrations were increased in both groups, but only nonsmokers showed a significant increase in the lag-phase (44.9+/-9.5 min at baseline, 41.4+/-6.5 min after depletion, and 49.0+/-8.9 min after supplementation; P<0.01) compared with depletion. CONCLUSIONS: In this short-term intervention study, a dietary intake of >40 mg/day of lycopene by a group of nonsmoking individuals significantly reduced the susceptibility of LDL to oxidation, whereas an equivalent increase in lycopene by a group of smokers showed no such effect.						
Heart: oxidation	Porrini M	Lymphocyte lycopene concentration and DNA protection from oxidative damage is increased in women after a short period of tomato consumption. Porrini M, Riso P. J Nutr. 2000 Feb;130(2):189-92.	2000	Several epidemiologic studies have suggested a role of tomato products in protecting against cancer and chronic diseases. In nine adult women, we evaluated whether the consumption of 25 g tomato puree (containing 7 mg lycopene and 0.3 mg beta-carotene) for 14 consecutive days increased plasma and lymphocyte carotenoid concentration and whether this was related to an improvement in lymphocyte resistance to an oxidative stress (500 micromol/L hydrogen peroxide for 5 min). Before and after the period of tomato intake, carotenoid concentrations were analyzed by HPLC and lymphocyte resistance to oxidative stress by the Comet assay, which	Interv		(-) ↓ DNA damage (comet assay)			

				detects DNA strand breaks. Intake of tomato puree increased plasma (P <0.001) and lymphocyte (P<0.005) lycopene concentration and reduced lymphocyte DNA damage by approximately 50% (P<0.0001). Beta-carotene concentration increased in plasma (P<0.05) but not in lymphocytes after tomato puree consumption. An inverse relationship was found between plasma lycopene concentration (r = -0.82, P<0.0001) and lymphocyte lycopene concentration (r = -0.62, P<0.01) and the oxidative DNA damage. In conclusion, small amounts of tomato puree added to the diet over a short period can increase carotenoid concentrations and the resistance of lymphocytes to oxidative stress.						
Heart: oxidation	Upritchard JE	Effect of supplementation with tomato juice, vitamin E, and vitamin C on LDL oxidation and products of inf lammatory activity in type 2 diabetes. Upritchard JE, Sutherland WH, Mann JI. Diabetes Care. 2000 Jun;23(6):733-8.	2000	OBJECTIVE: To compare the effects of short-term dietary supplementation with tomato juice, vitamin E, and vitamin C on susceptibility of LDL to oxidation and circulating levels of C-reactive protein (C-RP) and cell adhesion molecules in patients with type 2 diabetes. RESEARCH DESIGN AND METHODS: There were 57 patients with well-controlled type 2 diabetes aged <75 years treated with placebo for 4 weeks and then randomized to receive tomato juice (500 ml/day), vitamin E (800 U/day), vitamin C (500 mg/day), or continued placebo treatment for 4 weeks. Susceptibility of LDL to oxidation (lag time) and plasma concentrations of lycopene, vitamin E, vitamin C, C-RP, vascular cell adhesion molecule 1, and intercellular adhesion molecule 1 were measured at the beginning of the study, after the placebo phase, and at the end of the study. RESULTS: Plasma lycopene levels increased nearly 3-fold	RCT		(-) LDL oxidation ~~~~~ N CRP Cell adhesion molecules (CAM) Glucose			LDL ox CRP ICAM VCAM

				(P = 0.001), and the lag time in isolated LDL oxidation by copper ions increased by 42% (P = 0.001) in patients during supplementation with tomato juice. The magnitude of this increase in lag time was comparable with the corresponding increase during supplementation with vitamin E (54%). Plasma C-RP levels decreased significantly (-49%, P = 0.004) in patients who received vitamin E. Circulating levels of cell adhesion molecules and plasma glucose did not change significantly during the study. CONCLUSIONS: This study indicates that consumption of commercial tomato juice increases plasma lycopene levels and the intrinsic resistance of LDL to oxidation almost as effectively as supplementation with a high dose of vitamin E, which also decreases plasma levels of C-RP, a risk factor for myocardial infarction, in patients with diabetes. These findings may be relevant to strategies aimed at reducing risk of myocardial infarction in patients with diabetes.						
Heart: oxidation	Porrini M	Spinach and tomato consumption increases lymphocyte DNA resistance to oxidative stress but this is not related to cell carotenoid concentrations. Porrini M, Riso P, Oriani G. Eur J Nutr. 2002 Jun;41(3):95-100.	2002	BACKGROUND: The increased consumption of fruit and vegetables has been linked to protection against different chronic diseases, but the dietary constituents responsible for this association have not been clearly identified. AIM OF THE STUDY: We evaluated the effect of spinach and spinach+tomato puree consumption on cell DNA resistance to an oxidative stress. METHODS: To this aim, in a dietary controlled intervention study, 9 healthy female volunteers consumed a basal diet low in carotenoids (< 600	Interv		N			DNA ox Healthy

				microg/day) enriched with daily portions (150 g) of spinach (providing about 9 mg lutein, 0.6 mg zeaxanthin, 4 mg beta-carotene) for 3 weeks (from day 0 to day 21) followed by a 2 week wash-out period (basal diet) and finally another 3 weeks (from day 35 to day 56) of diet enriched with daily portions of spinach (150 g) + tomato puree (25 g, providing about 7 mg lycopene, 0.3 mg beta-carotene). At the beginning and the end of each period of vegetable intake, blood samples were collected for lymphocyte separation. Carotenoid concentrations of lymphocytes were determined by HPLC and DNA damage was evaluated by the comet assay following an ex vivo treatment with H2O2. RESULTS: During the first period of spinach consumption, lymphocyte lutein concentration did not increase significantly (1.6 to 2.2 mmol/1012 cells) while lycopene and beta-carotene concentrations decreased significantly (1.0 to 0.1 mmol/1012 cells, $P < 0.001$, and 2.2 to 1.2 mmol/1012 cells, $P < 0.05$, respectively). Lutein and lycopene concentrations increased after spinach+tomato puree consumption (1.2 to 3.5 mmol/1012 cells, $P < 0.01$, and 0.1 to 0.7 mmol/1012 cells, $P < 0.05$, respectively). The increase may be attributed to the addition of tomato puree to spinach; however, the different concentrations of carotenoids in lymphocytes registered at the beginning of the two intervention periods may have affected the results. DNA resistance to H2O2 insult increased significantly after both the enriched diets ($P < 0.01$); however, no "additive effect" was seen after spinach + tomato puree consumption. In the spinach + tomato intervention period an inverse correlation was observed between lymphocyte lycopene concentration						

				and DNA damage, but this seems not able to explain the protection observed. CONCLUSIONS: The consumption of carotenoid-rich foods even for a short period of time gives protection against oxidative stress. The results obtained seem to suggest that this protective role is not specifically related to carotenoids. However they may contribute together with other substances present in vegetables to lymphocyte resistance to oxidative damage.						
Heart: oxidation	Hadley CW	The consumption of processed tomato products enhances plasma lycopene concentrations in association with a reduced lipoprotein sensitivity to oxidative damage. Hadley CW, Clinton SK, Schwartz SJ. J Nutr. 2003 Mar;133(3):727-32	2003	Lycopene, the predominant carotenoid in tomatoes, is hypothesized to mediate the health benefits of tomato products. We designed a study to examine the change in plasma lycopene and resistance of lipoproteins to ex vivo oxidative stress. Healthy individuals (n = 60; age >40 y; 30 men/30 women) consumed a lycopene-free diet for 1 wk and were subsequently randomized to receive 35 +/- 1, 23 +/- 1 or 25 +/- 1 mg lycopene/d from Campbell's Condensed Tomato Soup (CS), Campbell's Ready To Serve Tomato Soup (RTS) or V8 Vegetable Juice (V8), respectively, for 15 d. Total plasma lycopene concentrations decreased from 0.499 +/- 0.044 to 0.322 +/- 0.027 (35%, P < 0.0001) micro mol/L for the 60 participants during the 7-d washout period. After intervention, total lycopene concentrations increased for those consuming CS, RTS and V8 (compared with the washout period for each group) to 0.784 +/- 0.083 (123%, P < 0.0001), 0.545 +/- 0.061 (57%, P < 0.01) and 0.569 +/- 0.061 (112%, P < 0.0001) micro mol/L, respectively. The concentrations of all lycopene isomers decreased during the washout period. As a percentage of plasma total lycopene isomers for the 60	Interv		(-)			↓ LDLox

				subjects, all-trans-lycopene decreased from 44.4 +/- 1.2 to 39.6 +/- 1.2 (P < 0.0001), whereas total cis-lycopene isomers increased from 55.6 +/- 1.2 to 60.4 +/- 1.2 (P < 0.0001) during the washout period, a shift that was reversed by consumption of tomato products for 15 d. The ex vivo lipoprotein oxidation lag period, used as a measure of antioxidant capacity, increased significantly from 64.7 +/- 2.4 min at the end of the washout period (all groups) to 70.1 +/- 4.0 (P < 0.05), 68.3 +/- 2.4 (P < 0.05) and 71.7 +/- 4.0 min (P < 0.01) after treatment for the CS, RTS and V8 groups, respectively. This study shows that lycopene concentrations and isomer patterns change rapidly with variation in dietary intake. In addition, 15 d of tomato product consumption significantly enhanced the protection of lipoproteins to ex vivo oxidative stress.						
Heart: oxidation	Visioli F	Protective activity of tomato products on in vivo markers of lipid oxidation. Visioli F, Riso P, Grande S, Galli C, Porrini M. Eur J Nutr. 2003 Aug;42(4):201-6.	2003	BACKGROUND: It has been suggested that regular consumption of tomato products improves antioxidant defenses due to their endogenous antioxid ant compounds, notably lycopene. AIM OF THE STUDY: We evaluated the effects of tomato consumption on parameters of lipid oxidation in healthy human volunteers. METHODS: Twelve females (enrolled at T-7), after a one-week of carotenoid-poor diet (T0), were instructed to supplement the same diet with different tomato products (raw, sauce, and paste), thereby providing approximately eight mg lycopene/day for three weeks (T21). Blood samples were periodically collected in order to evaluate plasma carotenoid concentrations, plasma antioxidant capacity, and susceptibility of LDL to metal ion-induced oxidation.	Interv	(-)				Anti-ox capacity LDL ox Ox stress

				Furthermore, 8-iso-PGF(2alpha), a marker of in vivo oxidative stress, was analyzed in the 24-hour urine. RESULTS: Carotenoid concentrations decreased significantly during the carotenoid-poor diet (P < 0.05), while lycopene concentrations increased significantly after tomato consumption (P < 0.001). The antioxidant capacity of plasma did not vary during the study. Conversely, LDL oxidizability decreased after tomato consumption, as demonstrated by a shortening of the lag phase (P < 0.001). This parameter was significantly correlated with lycopene concentration (r = 0.36, P < 0.05). The excretion of 8-iso-PGF(2alpha) in urine was also significantly lower (-53%, P < 0.05 compared with T0) after tomato supplementation. CONCLUSIONS: These results further support a role for tomato products in the prevention of lipid peroxidation, a risk factor of atherosclerosis and cardiovascular disease.						
Heart: oxidation	Briviba K	Supplementation of a diet low in carotenoids with tomato or carrot juice does not affect lipid peroxidation in plasma and feces of healthy men. Briviba K, Schnabele K, Rechkemmer G, Bub A.	2004	Antioxidant properties of carotenoids are thought to be at least partly responsible for the protective effects of fruits and vegetables rich in carotenoids against colon cancer. There are large amounts of in vitro data supporting this hypothesis. But there is little known about the antioxidant effects of carotenoid-rich food in vivo particularly in the gastrointestinal tract. In a randomized, crossover trial, healthy men (n = 22) who were consuming a low-carotenoid diet drank 330 mL/d tomato juice or carrot juice for 2 wk. Antioxidant capacity was assessed by the "lag time" of ex vivo LDL oxidation induced by copper and lipid	RCT		(-) ↑ lagtime LDLox			

		J Nutr. 2004 May;134(5):1081-3.		peroxidation as determined by measurements of malondialdehyde (MDA) in plasma and feces using HPLC with fluorescence detection. Although consumption of both carotenoid-rich juices for 2 wk increased the carotenoid level in plasma and feces ($P < 0.001$), the antioxidant capacity of LDL tended to be increased by only approximately 4.5% ($P = 0.08$), and lipid peroxidation in the men's plasma and feces was not affected. Thus, processes other than lipid peroxidation could be responsible for the preventive effects of tomatoes and carrots against colon cancer.						
Heart: oxidation	Rao AV	Processed tomato products as a source of dietary lycopene: bioavailability and antioxidant properties. Rao AV. Can J Diet Pract Res. 2004 Winter;65(4):161-5.	2004	Oxidative stress is one of the major contributors to increased risk of chronic diseases. A diet rich in tomatoes and tomato products containing lycopene, a carotenoid antioxidant, has been found to protect against these chronic diseases by mitigating oxidative damage. The study aim was to evaluate the effects of a long-term tomato-rich diet, consisting of various processed tomato products, on bioavailability and antioxidant properties of lycopene. Seventeen healthy human subjects (ten men, seven non-pregnant women) participated in the study. Following a two-week washout period during which subjects avoided foods containing lycopene, all subjects consumed test tomato products including tomato juice, tomato sauce, tomato paste, ketchup, spaghetti sauce, and ready-to-serve tomato soup providing 30 mg of lycopene a day for four weeks. At the end of treatment, serum lycopene level increased significantly ($p < 0.05$), from 181.79 +/- 31.25 to 684.7 +/- 113.91 nmol/L. Similarly, total antioxidant potential increased significantly ($p < 0.05$), from 2.26 +/- 0.015 to 2.38 +/- 0.17 mmol/L Trolox equivalent. Lipid and	Interv		(-)			Lipid ox Prot ox

				protein oxidation was reduced significantly (p <0.05). The results suggest that a tomato-rich diet containing different sources of lycopene can increase serum lycopene levels and reduce oxidative stress effectively.						
Heart: oxidation	Riso P	Lycopene and vitamin C concentrations increase in plasma and lymphocytes after tomato intake. Effects on cellular antioxidant protection. Riso P, Visioli F, Erba D, Testolin G, Porrini M. Eur J Clin Nutr. 2004 Oct;58(10):1350-8.	2004	OBJECTIVE: This study seeks to verify whether the regular consumption of small amounts of tomato products can protect lymphocyte DNA and lipids from oxidative damage. DESIGN: Standardized dietary intervention. SUBJECTS: Twelve healthy female subjects (mean age 25.2 y). INTERVENTION: Subjects were instructed to follow a standardized diet for 1 week, followed by 3 weeks consumption of the same diet enriched with small amounts of different tomato products providing as a mean 8 mg lycopene, 0.5 mg beta-carotene and 11 mg vitamin C per day. Plasma and lymphocyte concentrations of carotenoids, vitamin C and vitamin E were analysed. Ex vivo protection of lymphocyte DNA from oxidative injury produced by iron ions was evaluated by means of the Comet assay, and lipid peroxidation by HPLC analysis of malondialdehyde (MDA). RESULTS: Dietary intervention with tomato products increased lycopene concentration both in plasma (P < 0.001) and lymphocytes (P < 0.01). Vitamin C concentrations increased by approximately 35% in plasma (P < 0.05) and by approximately 230% in lymphocytes (P < 0.005). Vitamin E decreased significantly in plasma (P < 0.0001) but not in lymphocytes. Finally, there was an improved protection from	Interv	(-)/N				DNA ox Lipid ox

				DNA oxidative damage (P < 0.05) with no significant effect on MDA levels. CONCLUSIONS: Our results suggest that tomato products are not only good sources of lycopene but also sources of bioavailable vitamin C. A Regular intake of small amounts of tomato products can increase cell protection from DNA damage induced by oxidant species. This effect may originate from the synergism of different antioxidants present in tomatoes.						
Heart: oxidation	Tyssandier V	Effect of tomato product consumption on the plasma status of antioxidant microconstituents and on the plasma total antioxidant capacity in healthy subjects. Tyssandier V, Feillet-Coudray C, Caris-Veyrat C, Guilland JC, Coudray C, Bureau S, Reich M, Amiot-Carlin MJ, Bouteloup-Demange C, Boirie Y, Borel P. J Am Coll Nutr. 2004 Apr;23(2):148-56.	2004	OBJECTIVES: to identify the plasma antioxidant microconstituents mainly affected by tomato product consumption, to check whether tomato product consumption can affect antioxidant status, and to identify tomato-product antioxidant-microconstituents mainly involved in the effect of these products on oxidative stress. DESIGN: Medium-term dietary supplementation study. SETTING: Human Nutrition Laboratory, Clermont-Ferrand, France. SUBJECTS: Twenty healthy young (20 < years < 40), non obese (18 < BMI (kg/m2) < 25), females were recruited by advertisement. All of them completed the study. INTERVENTION: The usual diet of the subjects was supplemented for three weeks with 96 g/day tomato puree. The volunteers then avoided tomato-product-rich foods for a subsequent three-week period. Measures of	Interv		(-)			(-) Anti-ox status/ capacity

				Outcome: Fasting blood samples were collected the day before supplementation, the day after the supplementation period, and the day after the depletion period. The status of several antioxidant microconstituents (plasma microconstituent concentrations), and the antioxidant status (plasma total antioxidant capacity) were assessed. RESULTS: Supplementation with tomato puree significantly increased plasma lycopene, beta-carotene and lutein. Conversely it did not significantly affect plasma vitamin C and E, plasma antioxidant trace metals (Cu, Zn and Se), and plasma total antioxidant capacity. Avoidance of tomato-product-rich foods for three weeks significantly ($p < 0.05$) decreased plasma lycopene, beta-carotene, lutein and vitamin C, as well as plasma total antioxidant capacity. Plasma total antioxidant capacity, as measured by chemiluminescence, was positively related ($p < 0.05$) to the status of lycopene, vitamin C and beta-carotene. CONCLUSIONS: Tomato product consumption can affect not only the lycopene status, but also that of other antioxidant microconstituents (beta-carotene and lutein). Lycopene, but also beta-carotene, are apparently the main tomato microconstituents responsible for the effect of tomato products on antioxidant status.						
Heart: oxidation	Bub A	Paraoxonase 1 Q192R (PON1-192) polymorphism is associated with reduced lipid peroxidation in	2005	The HDL-bound enzyme paraoxonase (PON) protects LDL from oxidation and may therefore attenuate the development of atherosclerosis. We examined the effect of tomato and carrot juice consumption on PON1	RCT	(-) ↓ MDA in QR/RR ~~~~ N				(+) ↑ plasma [lyco]

		healthy young men on a low-carotenoid diet supplemented with tomato juice. Bub A, Barth SW, Watzl B, Briviba K, Rechkemmer G. Br J Nutr. 2005 Mar;93(3):291-7.		activity and lipid peroxidation in healthy young volunteers with different PON1-192 genotypes (Q/R substitution at position 192). In this randomized cross-over study twenty-two healthy, non-smoking men on a low-carotenoid diet received 330 ml/d tomato juice (37.0 mg lycopene, 1.6 mg beta-carotene) or carrot juice (27.1 mg beta-carotene, 13.1 mg alpha-carotene) for 2 weeks. Intervention periods were preceded by 2-week low-carotenoid intake. We determined the PON1-192 genotype by restriction fragment length polymorphism-polymerase chain reaction (RFLP-PCR) and measured ex vivo LDL oxidation (lag time), plasma malondialdehyde and PON1 activity at the beginning and end of each intervention period. At baseline, lag time was higher (P<0.05) in QQ (111 (sd 9) min) than in QR/RR subjects (101 (sd 8) min). Neither tomato nor carrot juice consumption had significant effects on PON1 activity. However, tomato juice consumption reduced (P<0.05) plasma malondialdehyde in QR/RR (Delta: -0.073 (sd 0.11) micromol/l) as compared to QQ subjects (Delta:+0.047 (sd 0.13) micromol/l). Carrot juice had no significant effect on malondialdehyde irrespective of the PON1-192 genotype. Male volunteers with the QR/RR genotype showed an increased lipid peroxidation at baseline. Although tomato and carrot juice fail to affect PON1 activity, tomato juice intake reduced lipid peroxidation in healthy volunteers carrying the R-allele of the PON1-192 genotype and could thus contribute to CVD risk reduction in these individuals.		both QQ and QR/RR groups: PON(-)1 activity & LDLox				Ox
Heart: oxidation	Bose KS	Effect of long term supplementation of tomatoes	2006	The objective of the present study is to evaluate the beneficial effect of tomatoes, which are a rich source of	Interv	(-)				Ox

		(cooked) on levels of antioxidant enzymes, lipid peroxidation rate, lipid profile and glycated haemoglobin in Type 2 diabetes mellitus. Bose KS, Agrawal BK. West Indian Med J. 2006 Sep;55(4):274-8.		lycopene, a relatively new carotenoid known to play an important role in human health. In this study, the lipid peroxidation rate was investigated by estimating malondialdehyde (TBARS) levels of antioxidant enzymes like SOD, GSH-Px, GR, GSH, lipid profile, which includes total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein, very low density lipoprotein, and glycated haemoglobin HbA1c in (n = 40) the Type 2 diabetic group (n = 40) and an age-matched control group (n = 50). Significantly lower levels of antioxidant enzymes and very high lipid peroxidation rate in the Type 2 diabetic group were observed when compared to controls ($p < 0.001$). Likewise, significantly higher levels of lipid profile and glycated haemoglobin (HbA1c) in the diabetic group were observed when compared with control ($p < 0.001$). Long term tomato supplementation in diabetes mellitus showed a significant improvement in the levels of antioxidant enzymes and decreased lipid peroxidation rate ($p < 0.001$), but there were no significant changes in lipid profile and glycated haemoglobin HbA1c levels ($p > 0.10$). These findings suggest that tomato lycopene may have considerable therapeutic potential as an antioxidant but there was no significant lipid lowering effect in Type 2 diabetes mellitus.						
Heart: oxidation	Sanchez-Moreno C	Mediterranean vegetable soup consumption increases plasma vitamin C and decreases F2-isoprostanes, prostaglandin E2 and monocyte chemot actic	2006	Consumption of fruits and vegetables is associated with a reduced risk of death from all causes including heart disease and stroke. In this work, the bioavailability of vitamin C from a Mediterranean vegetable soup (gazpacho) constituted mainly of tomato, pepper and cucumber, and its influence on plasma vitamin C, 8-epi-prostaglandin F(2alpha) (8-epi-	Interv	(-)/N				Emph. on Vit C ox and cytokines

		protein-1 in healthy humans. Sanchez-Moreno C, Cano MP, de Ancos B, Plaza L, Olmedilla B, Granado F, Martin A. J Nutr Biochem. 2006 Mar;17(3):183-9. Epub 2005 Aug 15.		PGF2alpha), prostaglandin E2 (PGE2), monocyte chemotactic protein-1 (MCP-1), and the cytokines/tumor necrosis factor-alpha (TNF-alpha), interleukin-1beta (IL-1beta), and IL-6 concentrations in a healthy human population were assessed. Six men and six women consumed 500 ml of commercial gazpacho per day for 14 days, corresponding to an intake of 78 mg of ascorbic acid per day. There were no differences (P = .22) in baseline plasma vitamin C concentrations between the men and women. The maximum increase (P < .05) in plasma vitamin C occurred 4 h postdose in both men and women. Vitamin C concentrations were significantly higher (P < .03) on Days 7 and 14 of the intervention. Baseline concentrations of uric acid and 8-epi-PGF2alpha were significantly higher (P < or = .032) in men than in women. Baseline concentrations of 8-epi-PGF2alpha decreased significantly (P < or = .05) by Day 14 of the intervention. A significant inverse correlation was observed between vitamin C and 8-epi-PGF2alpha (r = -.415, P = .049). Baseline concentrations of PGF2 and MCP-1 were significantly higher (P< or = .025) in men than in women but decreased significantly (P< or = .05) by Day 14 of the intervention. No effect on TNF-alpha, IL-1beta and IL-6 was observed at Day 14 of the intervention. Drinking gazpacho (500 ml/day) significantly increases plasma concentrations of vitamin C and significantly decreases 8-epi-PGF2alpha, PGE2 and MCP-1 concentrations in healthy humans.						
Heart: oxidation	Bose KS	Effect of lycopene from cooked tomatoes on serum	2007	INTRODUCTION: This present study aims to evaluate the beneficial effect of tomatoes, a rich source of lycopene, which is a relatively new carotenoid	Interv		(-)			Ox

		antioxidant enzymes, lipid peroxidation rate and lipid profile in coronary heart disease. Bose KS, Agrawal BK. Singapore Med J. 2007 May;48(5):415-20.		known to play an important role in human health and disease. METHODS: We investigated the lipid peroxidation rate by estimating malondialdehyde (MDA), levels of serum enzymes involved in antioxidant activities such as superoxide dismutase, glutathione peroxidase, glutathione reductase, reduced glutathione and lipid profile, which includes total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein and very low density lipoprotein in a coronary heart disease (CHD) group and an age-matched control group. RESULTS: We observed significantly lower levels of serum antioxidant enzymes and very high lipid peroxidation rate in the CHD group, when compared to the controls (p-value is less than 0.001). At the same time, we observed significantly higher levels of lipids in the CHD group, when compared to the controls (p-value is less than 0.001). 60 days of tomato supplementation in the CHD group showed a significant improvement in the levels of serum enzymes involved in antioxidant activities and decreased lipid peroxidation rate (p-value is less than 0.001), but there were no significant changes in lipid profile (p-value is greater than 0.10). CONCLUSION: These findings suggest that tomato lycopene may have considerable therapeutic potential as an antioxidant but may not be used as a hypolipidaemic agent in CHD.						
Heart: oxidation	Briviba K	No differences in DNA damage and antioxidant capacity between intervention	2008	The effects of different intake levels of vegetables and fruit (VF) on some cancer-relevant biomarkers such as DNA damage and oxidative stress were investigated. In	RCT	N				↑ plasma [lyco] across all groups ~~~~~

		groups of healthy, nonsmoking men receiving 2, 5, or 8 servings/day of vegetables and fruit. Briviba K, Bub A, Moseneder J, Schwerdtle T, Hartwig A, Kulling S, Watzl B. Nutr Cancer. 2008;60(2):164-70.		a randomized controlled trial, 64 nonsmoking male subjects were asked to consume a diet with 2 servings of VF/day for 4 wk. Then subjects were randomly assigned to 1 of 3 groups with either a low (2 servings/day), medium (5 servings/day), or high (8 servings/day) intake level of VF for another 4 wk. At the end of study, the plasma lutein, zeaxanthin, alpha-carotene, and beta-carotene but not cryptoxanthin and lycopene concentrations were significantly higher in subjects consuming 8 servings/day than in those receiving 2 servings/day. Different levels of VF consumption and plasma carotenoid concentrations did not result in differences in the levels of endogenous DNA strand breaks, oxidative DNA damage, antigenotoxic capacity of lymphocytes, plasma markers for lipid peroxidation (malondialdehyde, 8-iso-prostaglandin-F2alpha) and antioxidant capacity [trolox-equivalent antioxidant capacity assay]. Thus, although consumption of 8 servings vs 2 servings/day of VF for 4 wk significantly increased the carotenoid level in plasma, there were no differences in DNA damage, lipid peroxidation, and antioxidant capacity markers among healthy, well-nourished, nonsmoking men.						N DNA damage, lipid peroxidation, anti-ox capacity
Heart: oxidation	Burri BJ	Tangerine tomatoes increase total and tetra-cis-lycopene isomer concentrations more than red	2008	Lycopene, or the foods that contain it, may prevent prostate cancer. Studies suggest that some cis-lycopene isomers are more bioavailable than the trans-lycopene isomer. We hypothesized that	RCT		(-)			

		tomatoes in healthy adult humans. Burri BJ, Chapman MH, Neidlinger TR, Seo JS, Ishida BK. Int J Food Sci Nutr. 2008 Apr 10:1-16. [Epub ahead of print]		tangerine tomatoes, which predominantly contain the tetra-cis isomer, should be a good source of bioavailable lycopene. We fed lunches containing 300 g tangerine or red tomato sauce per day to 21 healthy adults in a double-blind crossover design. We collected blood at baseline and after each treatment and washout period. We measured tetra-cis, other cis, and trans lycopene, as well as other carotenoids, by reversed-phase high-performance liquid chromatography. Both tomato sauces increased lycopene concentrations in blood, but the tangerine tomato sauce caused a greater increase of total and tetra-cis-lycopene. The cis isomer(s) may also have facilitated absorption of the trans-lycopene isomer. Indices of oxidative damage decreased as serum lycopene concentrations increased. Our results suggest that total lycopene concentrations can be increased by substituting tetra-cis-lycopene-rich tangerine tomatoes for common red tomatoes in the diet.						
Heart: oxidation	Lee CY	Limited antioxidant effect after consumption of a single dose of tomato sauce by young males, despite a rise in plasma lycopene. Lee CY, Isaac HB, Huang SH, Long LH, Wang H, Gruber J, Ong CN,	2009	This study investigated the effect of a single dose of tomato sauce on healthy male volunteers in a randomized crossover study. Healthy male subjects (n = 10) were enrolled. Placebo (rice and olive oil) or tomato (tomato sauce, rice and olive oil) meals were provided to the volunteers. Blood and urine samples were taken before consumption of meal (0 h) and 2, 4, 6, 24 and 48 h after meal. Consumption of tomato sauce increased plasma lycopene level by 5-22%, with a	RCT		(-)/N			PP ox stress markers 48 h urinary marker

		Kelly RP, Halliwell B. Free Radic Res. 2009 Jun;43(6):622-8.		maximum level at 24 h ($p<0.01$) after the meal. Levels of plasma F(2)-isoprostanes, hydroxyeicosatetraenoic acid products, allantoin and urinary 8-hydroxy-2'-deoxyguanosine did not change after either meal, but urinary F(2)-isoprostanes ($p<0.05$) significantly decreased at 48 h compared to 0 h after the tomato sauce meal. This study showed that a single dose of tomato sauce meal had only a limited antioxidant effect in vivo.						
Heart: oxidation and inflammation	Centritto F	Dietary patterns, cardiovascular risk factors and C-reactive protein in a healthy Italian population. Centritto F, Iacoviello L, di Giuseppe R, De Curtis A, Costanzo S, Zito F, Grioni S, Sieri S, Donati MB, de Gaetano G, Di Castelnuovo A; Moli-sani Investigators. Nutr Metab Cardiovasc Dis. 2009 Dec;19(10):697-706. Epub 2009 Mar 19.	2009	BACKGROUND AND AIMS: Dietary habits have been associated with cardiovascular disease (CVD) risk factors. This study aimed at evaluating the association of non-predefined dietary patterns with CVD risk profile and C-reactive protein (CRP). METHODS AND RESULTS: We analyzed 7646 healthy subjects from the Moli-sani project, an on-going cross-sectional cohort study of men and women aged >or=35, randomly recruited from a general Italian population. The Italian EPIC food frequency questionnaire was used. Food patterns were generated using principal factor analysis (PFA) and reduced rank regression (RRR). Three dietary patterns were identified by PFA. The "Olive Oil and Vegetables" pattern, characterized by high intake of olive oil, vegetables, legumes, soups, fruits and fish, was associated with relatively lower values of glucose, lipids, CRP, blood pressure and individual global CVD risk score. The "Pasta and Meat" pattern, characterized by high intake of pasta, tomato sauce, red meat, animal fats and alcohol, was positively associated with glucose, lipids, CRP and CVD risk score. The "Eggs and Sweets" pattern, characterized by positive loadings of eggs, processed meat, margarines,	CS	(+) Dietary pattern				

				butter, sugar and sweets, was associated with high values of CRP. The first RRR pattern was similar to the "Pasta and Meat" pattern both in composition and association with CVD risk profile. CONCLUSIONS: In a large healthy Italian population, non-predefined dietary patterns including foods considered to be rather unhealthy, were associated with higher levels of cardiovascular risk factors, CRP and individual global CVD risk, whereas a "prudent-healthy" pattern was associated with lower levels. Additional Collaborators (78): Iacoviello L, Donati MB, de Gaetano G, Ruffilli MP, Giampaoli S, Vermylen J, Carrasco Ide P, Sbaffi G, Assanelli D, Alessandrini F, Centritto V, Muti P, Shunemann H, Storti S, Zito F, Bonanni A, Cerletti C, De Curtis A, Di Castelnuovo A, Iacoviello L, Mascioli A, Olivieri M, Di Castelnuovo A, Costanzo S, di Giuseppe R, Centritto F, Olivieri M, Giacci M, Padulo A, Petraroia D, De Curtis A, Magnacca S, Marracino F, Silvestri C, Latella MC, Quacquaruccio G, de Gaetano M, Graziano M, Bonanni A, Bonaccio ML, De Lucia F, Vohnout B, Cutrone A, Havranova A, Zito F, Persichillo M, Di Stefano I, Pampuch A, Vohnout B, Arcari A, Costanzo S, Caccamo S, Caruso V, Chiovitti A, Barbato D, Di Giorgio C, Rago L, Cugino D, Castaldi C, Ferri A, Guszcz T, Mignogna M, Zito F, di Giuseppe R, Buonaccorsi L, Cavone C, Centritto F, De Lucia F, Di Lillo M, Di Stefano I, Fanelli F, Molinaro A, Plescia E, Santimone I, Castaldi C, D'Angelo D, Galuppo G, Ramacciato R.							
Heart: oxidation, inflammation	Jacob K	Influence of lycopene and vitamin C from tomato juice on	2008	A human study was carried out to investigate whether tomato juice, rich in natural lycopene and fortified with vitamin C, is able to reduce several	RCT		(-) ↓ chol (TC)			

		biomarkers of oxidative stress and inflammation. Jacob K, Periago MJ, Bahm V, Berruezo GR. Br J Nutr. 2008 Jan;99(1):137-46. Epub 2007 Jul 19.		biomarkers of oxidative stress and inflammation and whether the effect can be attributed to lycopene, vitamin C or any other micronutrient. Following a 2-week depletion phase, volunteers were assigned randomly to ingest either tomato juice with (LC) or without (L) vitamin C fortification for 2 weeks (daily dose 20.6 mg lycopene and 45.5/435 mg vitamin C). Plasma and urine were analysed for carotenoids and vitamin C, lipid status, antioxidant capacity, thiobarbituric acid reactive substances (TBARS) and 8-epi-PGF2alpha, protein carbonyls, cytokines IL-1beta and TNFalpha and C-reactive protein (CRP). The consumption of tomato juice led to a reduction in total cholesterol levels (L: 157.6 v. 153.2 mg/dl, P = 0.008; LC: 153.4 v. 147.4 mg/dl, P = 0.002) and that of CRP (L: 315.6 v. 262.3 microg/l, P = 0.017; LC: 319.2 v. 247.1 microg/l, P = 0.001) in both groups. The vitamin C-fortified juice slightly raised the antioxidant capacity in urine and decreased TBARS in plasma and urine. All other markers were affected to a lesser extent or remained unchanged. Cholesterol reduction was correlated with lycopene uptake (P = 0.003), whereas the other effects could not be related with particular micronutrients. Any beneficial effects of tomato consumption for human health cannot be attributed only to lycopene and, as the additional supplementation with ascorbic acid indicates, a variety of antioxidants might be needed to optimize protection against chronic diseases.			↓ CRP			
Heart: T2DM	Liese AD	Food intake patterns associated with incident type 2 diabetes: the	2009	OBJECTIVE: Markers of hemostasis and inflammation such as plasminogen activator inhibitor-1 (PAI-1) and fibrinogen have been associated with risk of type 2 diabetes. We aimed to	PC	(+) tomato intake = ↑ PAI-1 and				

		Insulin Resistance Atherosclerosis Study. Liese AD, Weis KE, Schulz M, Tooze JA. Diabetes Care. 2009 Feb;32(2):263-8. Epub 2008 Nov 25.		identify food intake patterns influencing this pathway and evaluate their association with incident diabetes RESEARCH DESIGN AND METHODS: The Insulin Resistance Atherosclerosis Study cohort included 880 middle-aged adults initially free of diabetes. At the 5-year follow-up, 144 individuals had developed diabetes. Usual dietary intake was ascertained with a 114-item food frequency questionnaire. Using reduced rank regression, we identified a food pattern maximizing the explained variation in PAI-1 and fibrinogen. Subsequently, the food pattern-diabetes association was evaluated using logistic regression. RESULTS: High intake of the food groups red meat, low-fiber bread and cereal, dried beans, fried potatoes, tomato vegetables, eggs, cheese, and cottage cheese and low intake of wine characterized the pattern, which was positively associated with both biomarkers. With increasing pattern score, the odds of diabetes increased significantly (Ptrend < 0.01). After multivariate adjustment, the odds ratio comparing extreme quartiles was 4.3 (95% CI 1.7-10.8). Adjustment for insulin sensitivity and secretion and other metabolic factors had little impact (4.9, 1.8-13.7). CONCLUSIONS: Our findings provide support for potential behavioral prevention strategies, as we identified a food intake pattern that was strongly related to PAI-1 and fibrinogen and independently predicted type 2 diabetes.		↑ fibrinogen				