

Bone

Plasma/Serum Lycopene and Disease Risk

Disease type	First Author	Study Title and Complete Citation	Date	Abstract	Study Type	G.Tom +, N, -	P.Tom +, N, -	F.Tom +, N, -	Lyco +, N, -	Other +, N, -
Bone	Maggio D	<p>Low levels of carotenoids and retinol in involuntal osteoporosis.</p> <p>Maggio D, Polidori MC, Barabani M, Tufi A, Ruggiero C, Cecchetti R, Aisa MC, Stahl W, Cherubini A.</p> <p>Bone. 2006 Feb;38(2):244-8. Epub 2005 Sep 26.</p>	2006	<p>Previous epidemiological studies conducted in retinol-supplemented subjects showed an association between high serum levels or dietary intake of retinol and risk of hip fracture. On the other side, observational studies revealed that non-supplemented subjects with higher dietary intake of retinol lose less bone with age than subjects with lower intake. This discrepancy, currently unexplained, suggests that nutrition plays a major role in conditioning the effects of retinol on bone. Since retinol is derived from both retinoids--contained in animal food--and carotenoids--contained in vegetables and fruits--we evaluated a possible role of carotenoids in involuntal osteoporosis. Therefore, plasma levels of beta-carotene and other carotenoids, in addition to those of retinol, were measured in free-living, non-supplemented, elderly women with or without severe osteoporosis. Plasma levels of retinol and of all carotenoids tested, with the exception of lutein, were consistently lower in osteoporotic than in control women. A weak association was found only between retinol and femoral neck bone mineral density in osteoporotic women. Our study suggests a bone sparing effect of retinol, to which the provitamin A activity of some carotenoids might have contributed.</p>	CC				(-) ↓ plasma [Lyco] in osteo women	(-) ↓ plasma [carotinoid] in osteo women
Bone	Yang Z	<p>Serum carotenoid concentrations in postmenopausal women from the United States with and without osteoporosis.</p> <p>Yang Z, Zhang Z, Penniston KL, Binkley N, Tanumihardjo SA.</p> <p>Int J Vitam Nutr</p>	2008	<p>Antioxidant defenses may be compromised in osteoporotic women. Little is known about fruit and vegetable or carotenoid consumption among postmenopausal women. The primary carotenoids in human serum are alpha- and beta-carotene, lycopene, beta-cryptoxanthin, lutein, and zeaxanthin. This study investigated the interrelationships among serum carotenoid concentrations, fruit and vegetable intake, and osteoporosis in postmenopausal women (n = 59, 62.7 +/- 8.8 y). Bone density was assessed by dual energy x-ray absorptiometry and osteoporosis diagnosis was based upon T-scores. Serum samples (n = 53) and three-day diet records (n = 49) were analyzed. Logistic regression analyzed differences between carotenoids</p>	CC					Serum [lyco] ↓ in osteo group vs control

		Res. 2008 May;78(3):105-11.		after adjusting for serum retinol; supplement usage; milk, yogurt, fruit, and vegetable intake; and body mass index (BMI). Pearson statistics correlated carotenoids with specific fruit or vegetable intake. Serum lycopene concentrations were lower in the osteoporosis group than controls (p = 0.03). Beta-cryptoxanthin intake was higher in the osteoporosis group (p = 0.0046). Total fruit and vegetable intakes were correlated with serum lycopene and beta-cryptoxanthin (p = 0.03, 0.006, respectively). Serum alpha-carotene concentration was associated with carrot intake, and zeaxanthin and beta-cryptoxanthin with lettuce intake. Carotenoids that may have beneficial skeletal effects are lower in women with osteoporosis. Research is needed to identify potential protective mechanisms or utilization of carotenoids during osteoporosis.						
Bone	Rao LG	Lycopene consumption decreases oxidative stress and bone resorption markers in postmenopausal women. Rao LG, Mackinnon ES, Josse RG, Murray TM, Strauss A, Rao AV. Osteoporos Int. 2007 Jan;18(1):109-15. Epub 2006 Aug 29.	2007	<p>INTRODUCTION: Oxidative stress induced by reactive oxygen species (ROS) is associated with the risk of osteoporosis, and can be reduced by certain dietary antioxidants. Lycopene is an antioxidant known to decrease the risk of age-related chronic diseases, such as cancer. However, the role of lycopene in osteoporosis has not yet been investigated.</p> <p>MATERIALS AND METHODS: In a cross-sectional study, 33 postmenopausal women aged 50-60 years provided seven-day dietary records and blood samples. Serum samples were used to measure serum lycopene, lipid peroxidation, protein thiols, bone alkaline phosphatase (BAP), and cross-linked N-telopeptides of type I collagen (NTx). The serum lycopene per kilogram body weight of the participants was grouped into quartiles and associated with the above serum parameters using one-way ANOVA and the Newman-Keuls post-test.</p> <p>RESULTS: The results showed that groups with higher lycopene intake, as determined from the dietary records, had higher serum lycopene (p<0.02). A higher serum lycopene was found to be associated with a low NTx (p<0.005). Similarly, groups with higher serum lycopene had lower protein oxidation (p<0.05).</p> <p>DISCUSSION: In conclusion, these results suggest that the dietary antioxidant lycopene reduces oxidative stress</p>	CS					(-) ↑ serum [lyco] had ↓ ox stress ↓ NTx

				and the levels of bone turnover markers in postmenopausal women, and may be beneficial in reducing the risk of osteoporosis.						
Bone	Mackinnon ES	<p>Paraoxonase 1 polymorphisms 172T→A and 584A→G modify the association between serum concentrations of the antioxidant lycopene and bone turnover markers and oxidative stress parameters in women 25-70 years of age.</p> <p>Mackinnon ES, El-Sohehy A, Rao AV, Rao LG. J Nutrigenet Nutrigenomics. 2010;3(1):1-8. Epub 2010 Jul 28.</p>	2010	<p>BACKGROUND/AIMS: Polymorphisms of the paraoxonase 1 (PON1) enzyme affect the ability to protect LDL from oxidation. Oxidative stress is a risk factor for osteoporosis and antioxidants may be beneficial for prevention. The aim of this study was to determine whether PON1 genotypes modified the association between lycopene and bone turnover markers and oxidative stress parameters.</p> <p>METHODS: Blood samples from 107 women 25-70 years of age were analyzed for serum carotenoid concentrations, bone-specific alkaline phosphatase (BAP), N-telopeptide of type I collagen (NTx) and oxidative stress parameters. Subjects were genotyped for the 172T→A and 584A→G polymorphisms of PON1.</p> <p>RESULTS: The 172T→A polymorphism modified the association between lycopene and NTx ($p < 0.05$ for interaction). In the 172TT genotype, high serum lycopene was associated with decreased NTx ($p < 0.05$). The 584A→G polymorphism modified the association between lycopene and BAP ($p < 0.05$ for interaction). Additionally, in participants with the 584GG genotype, high serum lycopene was associated with high TBA-reactive substances ($p < 0.05$).</p> <p>CONCLUSIONS: These findings show that PON1 polymorphisms modify the association between serum concentrations of lycopene and oxidative stress parameters and bone turnover markers and may, therefore, moderate the risk of osteoporosis.</p>	CS				(-)	modified by PON1 SNPs
Bone: oxidation	Mackinnon ES	<p>Dietary restriction of lycopene for a period of one month resulted in significantly increased biomarkers of oxidative stress and bone</p>	2011	<p>BACKGROUND AND OBJECTIVES: Lycopene is a carotenoid commonly found in tomatoes and tomato products which acts as an antioxidant to decrease oxidative stress and osteoporosis risk. We wanted to determine the effects of a lycopene-restricted diet on oxidative stress parameters and bone turnover markers in postmenopausal women.</p>	Interv				(-)	SOD CAT GPx Alkaline Phos NTx

	<p>resorption in postmenopausal women.</p> <p>Mackinnon ES, Rao AV, Rao LG.</p> <p>J Nutr Health Aging. 2011 Feb;15(2):133-8.</p>	<p>SETTING: St. Michael 's Hospital, Toronto, ON, Canada.</p> <p>PARTICIPANTS AND STUDY DESIGN: 23 healthy postmenopausal women, 50-60 years old, provided blood samples at baseline and following a one-month lycopene-depletion period. MEASUREMENTS:Serum samples were analyzed for carotenoids; the oxidative stress parameters protein thiols and thiobarbituric-malondialdehyde reactive substances; the antioxidant enzymes superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx), and the bone turnover markers bone alkaline phosphatase and crosslinked N-telopeptide of type I collagen (NTx). A paired t-test was used to test for significant differences in bone turnover markers, oxidative stress parameters and antioxidant status after lycopene restriction.</p> <p>RESULTS: Dietary lycopene restriction resulted in significantly decreased serum lycopene ($p < 0.0001$), lutein/zeaxanthin ($p < 0.01$), and α-β -carotene ($p < 0.05$). GPx ($p < 0.01$), lipid and protein oxidation increased (not significant), while CAT and SOD were ignificantly depressed ($p < 0.05$ and $p < 0.005$, respectively). These changes coincided with significantly increased NTx ($p < 0.05$).</p> <p>CONCLUSIONS: These findings suggest that the daily consumption of lycopene may be important as it acts as an antioxidant to decrease bone resorption in postmenopausal women and may therefore be beneficial in reducing the risk of osteoporosis.</p>						
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