

Dietary vitamin C is positively associated with heel bone density but not with fracture risk in men and women in the EPIC-Norfolk study

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Previous epidemiological studies have reported positive associations between vitamin C and bone density^(1–3), possibly due to the role of vitamin C in bone collagen formation and maintenance as well as in bone remodelling^(4–6). However, to date, there have been limited studies in UK populations, particularly in men, and in relation to fracture risk. The present study aimed to investigate potential associations between dietary vitamin C intake and heel bone ultrasound and fracture risk in a UK population of men and women.

A representative sample of 2777 men and women aged 42–81 years from the EPIC-Norfolk study (25,000 men and women)⁽⁷⁾ were included in this case-cohort analysis. All participants gave informed consent and the study was approved by the Norwich District Health Authority ethics committee. Vitamin C intake was estimated from 7-day diet diaries. Heel bone density was measured using broadband ultrasound attenuation (BUA) and velocity of sound (VOS), and fracture incidence (all, hip, spine and wrist) was ascertained over 11 years follow-up. Multiple regression of BUA and VOS as well as hazard ratios (HRs) of fracture risk were plotted against quintiles of vitamin C intake, after adjustment for age, family history of osteoporosis (BUA and VOS only), body mass index (BMI), smoking and physical activity in all participants, and additionally for menopausal status and HRT in women. All analyses were performed using STATA (version 11, STATA Corp, USA).

Mean (SD) age was 63 years (9 years) in both genders and mean (SD) vitamin C intake was 91 mg/d (54 mg/d) in men and 94 mg/d (52 mg/d) in women. BUA increased significantly by 0.84% across all quintiles of vitamin C intake in women and VOS by 0.12% in men, after adjustment for potential confounding factors (P-trend<0.05). Moreover, women in quintile 5 had 4.2% greater BUA than those in quintile 1 (P = 0.021), and the 0.47% difference between extreme quintiles of VOS in men was borderline significant (P = 0.053). Fracture risk was not found to be associated with dietary vitamin C intake in this population at any site.

		Vitamin C intake (mg/d)							
		Men				Women			
		n	Q1 0–48	Q5 127–471	P-trend	n	Q1 0–52	Q5 129–655	P-trend
BUA (dB/MHz)	Mean	1103	88.3	88.5	0.43	1674	68.9	71.8	0.02
	SE		1.2	1.2			0.8	0.8	
VOS (m/s)	Mean	1103	1637	1645	0.02	1674	1621	1624	0.37
	SE		3	3			2	2	
HR (all fracture)	Mean	1108	1.00	0.90	0.98	1684	1.00	1.07	0.99
	95% CI			0.51–1.59				0.73–1.57	

BUA, broadband ultrasound attenuation; VOS, velocity of sound. Values are adjusted means and SE or hazard ratios with 95% CI of extreme quintiles of dietary vitamin C intake, and are adjusted for age, family history of osteoporosis (BUA and VOS only), BMI, smoking, physical activity, menopausal status and HRT (women only). All fracture incidence was n = 158 fractures in men and n = 381 fractures in women.

The present study found positive associations between dietary vitamin C and heel bone ultrasound but not fracture risk in men and women; and therefore the potential importance of vitamin C for bone health requires further investigation.

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