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Determinants of biomarkers of bone turnover in a sample of young European adults

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Bone-turnover markers (BTM) reflect whole-body rates of bone resorption and bone formation[(1)]. In order to interpret BTM data appropriately not only should the analytical performance of the assay be considered but also sources of pre-analytical variability[(2)]. Pre-analytical variability arises from both personal characteristics of the study population such as age, gender, ethnicity and menopausal status, and modifiable variables such as dietary factors and the timing and conditions of sample collection[(3)]. The current analysis investigates determinants of BTM in European men and women aged 30–43 years.

Lifestyle data, biomarkers of metabolic health, nutrient intakes and fasting levels of the biomarkers of bone formation (serum osteocalcin (OC) and bone-specific alkaline phosphatase (BAP)) and bone resorption (serum C-telopeptide of type 1 collagen (CTx) and urinary N-telopeptide of type I collagen (NTx)) were collected between October 2004 and March 2005 in 173 overweight adults (BMI 27.5–32.5 kg/m^2) from Iceland, Spain and Ireland. The lifestyle and health variables were collected as previously described[(4)]. Dietary intakes were measured using a 2 d weighed-food record. Multiple linear regression models examined relationships between lifestyle, health and dietary variables and BTM. Significant associations are summarised in the Table.

	β	SE	*P*		β	SE	*P*
Serum OC (ng/ml)				Urinary NTx (nM BCE/mM creatinine)			
Age (years)	−0.272	0.198	0.004	Country	−0.448	0.047	<0.001
Fasting serum 25(OH)D (nmol/l)	−0.214	0.014	0.025	Age (years)	−0.272	0.198	0.004
Fasting serum LDL-cholesterol (mg/dl)	−0.343	0.019	0.003	Vitamin C intake (mg/d)	0.189	0.049	0.046
Vitamin C intake (mg/d)	0.475	0.019	<0.001	Fat intake (g/d)	0.456	0.062	<0.001
Fibre intake (g/d)	−0.316	0.02	0.011	Vitamin B_{12} intake (μg/d)	0.272	0.063	0.027
K intake (mg/d)	−0.247	0.017	0.030	Serum CTx (ng/ml)			
Serum BAP (U/l)				Country	−0.370	0.037	<0.001
Gender	−0.448	0.017	<0.001	Gender	−0.361	0.042	<0.001
Fasting serum leptin (ng/ml)	−0.225	0.020	0.005	Smoking status	0.238	0.025	0.011
Fasting serum insulin (mU/l)	−0.159	0.018	0.024	Diastolic blood pressure (mmHg)	−0.242	0.043	0.011
Folic acid intake (μg/d)	0.137	0.018	0.051	Fasting serum cortisol (μg/dl)	0.238	0.044	0.008
				Vitamin C intake (mg/d)	0.202	0.038	0.020
				Fat intake (g/d)	0.520	0.070	0.002
				Vitamin B_{12} intake (μg/d)	0.205	0.041	0.029

25(OH)D, 25-hydroxyvitamin D; BCE, bone collagen equivalents; gender, men *v.* women; 0, 1; country, Iceland *v.* Spain *v.* Ireland; 1, 0, 0; smoking status, non-smoker *v.* smoker; 0, 1.

Alcohol intake, BMI (possibly because of the narrow range included) and systolic blood pressure did not appear to influence levels of BTM. Factors such as age, gender, country of origin and smoking status were significant determinants of BTM levels and should be accounted for when interpreting bone marker data. In addition, these data indicate that non-bone-related physiological indices, e.g. fasting insulin, may influence BTM. In addition, the influence of habitual diet on circulating levels of BTM requires further investigation.

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