

The Association of Dietary Acidity with Bone Mineral Density in Postmenopausal Women.

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Acid-base balance within the body may be upset by the Western style diet that contains a higher proportion of acid-forming animal foods compared to alkaline-forming fruit and vegetables. Increased net endogenous acid production (NEAP) together with insufficient excretion of acid by the kidneys, leads to homeostatic systems being used to buffer the excess acid. It is suggested that the dissolution of bone to release alkaline salts leads to a progressive decline in bone mineral content, which may be a contributory factor for osteoporosis. This study investigated whether dietary acidity was associated with poorer bone health in postmenopausal women.

The subjects were a subset of women who had been recruited in 1990-3 for the Aberdeen Prospective Osteoporosis Screening Study and who were invited to take part in another study in 2003 (n=289). The mean age (SD) of the women was 59.6 (2.2); they were more than 5 years postmenopausal; and were not taking hormone replacement therapy or any other treatment for their bones. They completed a four-day food diary and their bone mineral density (BMD) was measured by DXA (Lunar Prodigy) at the lumbar spine (LS) and total hip. Dietary intake was analysed using WinDiets and NEAP was calculated using the equation: $NEAP = \{(62 \times \text{protein/mEq potassium}) - 17.9\}$ in which protein and potassium are standardised to 8 MJ, the mean energy intake of the diet⁽¹⁾. The ratio of energy intake to basal metabolic rate was found to be below 1.1 for 20.4% of subjects, suggesting under-reporting or dietary restriction⁽²⁾.

NEAP was divided into quartiles (Q) and a trend was seen at LS for a lower BMD at Q4 compared to Q1 (mean (SD) 1.18 (0.17) g/cm² compared to 1.14 (0.15) g/cm²). This was significant after adjustment for age, weight, height, smoking, deprivation category and physical activity level (p=0.016). For the hip, BMD was lower for Q4 compared to Q2 and Q3 but BMD was also low at Q1 which may reflect a diet low in protein. These trends were not significant before or after adjustment for confounders.

Previous studies involving large populations have shown an association between NEAP calculated from food frequency questionnaires and markers of bone health^(3,4). Here we show an association for lower LS BMD with higher estimates of dietary acidity in a smaller study using food diaries. With regard to the hip, the lack of association may be due to limited statistical power. It has been suggested that although increased dietary acidity is associated with increased hip fracture risk, too little protein is also detrimental⁽⁵⁾. A balance between protein and dietary acidity may be required for optimal bone health.

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References:

- Frassetto LA, Todd KM, Morris RC Jr, Sebastian A. Am J Clin Nutr 1998;68:576-83.
- Goldberg GR, Black AE, Jebb SA, et al. Eur J Clin Nutr 1991;45:569-81.
- New SA, Bolton-Smith C, Grubb DA, Reid DM Am J Clin Nutr 1997;65:1831-9.
- Macdonald HM, New SA, Fraser WD, Campbell MK, Reid DM. Am J Clin Nutr 2005;81:923-33.
- Barzel Us, Aragaki A, Ritenbaugh C et al J Bone Miner Res 2004; 19 suppl 1: s160 (abstract).