Calcium intake, body fat, and bones—a complex relation1,2

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Two commonly cited risk factors for osteoporosis are dietary calcium intake and body weight (1). Recently, many reports have found that dairy and calcium intakes are inversely related to body fat (2, 3). In this issue of the Journal, Varenna et al (4) conclude that a low dietary calcium intake may increase the risk of osteoporosis in early postmenopausal women, but this negative effect can be offset by a high body mass index (BMI).

Varenna et al measured lumbar (L2–L4) bone mineral density (BMD), BMI, and dairy intake in 1777 healthy, early postmenopausal women in a cross-sectional, retrospective, observational study. Women in the lowest quartile of dairy intake had a greater BMI and were at a greater risk of being overweight than were women in the highest quartile of dairy intake (OR: 3.717; P < 0.001). Lumbar BMD was significantly lower in the lowest dairy intake quartile than in the highest dairy intake quartile (0.862 compared with 0.890 g/cm2; P = 0.003); however, the prevalence of osteoporosis, osteopenia, and postmenopausal fractures did not differ statistically between quartiles.

Given the interdependence of predictors of bone mass and fracture incidence, it should not be surprising that the literature is confusing. This is especially true for observational studies, for which the findings often depend on the adjustments made and are often fraught with confounders. Observational studies do not always find a relation between calcium or dairy intake and BMD—a marker of fracture risk. For example, dairy calcium intake was positively related to total hip BMD in elderly men (r = 0.23, P = 0.0019), but not in women, in the study by McCabe et al (5). However, when the same subjects were randomly assigned to consume a calcium supplement, a vitamin D supplement, or a placebo, both men and women responded equally to treatment (6). A cross-sectional study would not have predicted that women would have responded favorably to calcium supplementation.

Dietary constituents other than calcium should also be considered when evaluating the effect of dietary calcium on bone and body weight. High-calcium diets have been reported to be significantly higher in protein, saturated fat, vitamin D, magnesium, and phosphorus (7). Many observational studies evaluating calcium’s effects do not account for these nutrients as potential covariates or confounders, which may contribute to conflicting results.

In the study by Varenna et al, overweight had to be in the model to see a significant relation between dairy intake and osteoporosis risk. The protective effect of a high BMI on bone in individuals with low calcium intakes may not extend to higher BMIs than in the cohort study by Varenna et al. Although increasing weight can be protective against bone loss, excess adipose tissue can activate calcifying vascular cells and inhibit osteoblastic differentiation through lipid oxidation products (8).

Given our current knowledge, it is probably unwise to offer the choice between drinking milk and gaining weight for protection against bone loss. Most individuals would more likely benefit from the consumption of 3 servings of dairy products daily as recommended by the Dietary Guidelines for Americans (9) to protect against bone loss and to possibly manage healthy body weight.

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REFERENCES

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