Dear Sir:

We reported recently in the Journal that in free-living elderly white women, bone loss and hip fracture rates were greatest in those consuming diets with the highest ratio of animal to vegetable protein content (1). Those diets represented diets with the highest ratios of animal to vegetable foods consumed. Because animal foods tend to be net acid producing and vegetable foods net base producing (2), our results support the hypothesis that diet-dependent net endogenous acid production (NEAP) is a risk factor for bone loss and hip fracture in elderly white women.

In an accompanying editorial, Heaney (3) offers comments that might lead some readers to discount our findings and interpretation. He contends that opponents of the use of animal products “have had a disproportionate effect both on public consciousness and on the agenda of nutritional science itself,” and that it “would be surprising if the study had not been influenced to some extent by currents in the larger society.”

To allay the concerns of Journal readers, we offer a public opinion we published before having had any reason to suspect our article would be interpreted by anyone as having been unduly influenced by animal activist press:

By referring to the American diet as “protein-rich,” and linking dietary protein’s acid yield to bone damage, [the article entitled] “Could Diet Attack Bones? It’s a Beef About Meat” [(4)] might lead some readers to believe that Americans are eating too much protein. In fact, the protein content of American diets is below the evolutionary norm for humans, and therefore may be overall nutritionally suboptimal. For bone, the problem may not be too much acid from protein, but too little acid-neutralizing base from those types of plant foods that are rich in base, such as roots, tubers, fruits, and vegetable fruits and leaves. The plant foods that Americans eat most are cereal grains, such as wheat and rice, which are unusual plant foods in that they yield acid, not base. To boot, grains crowd out base-rich plant foods from the diet, helped in that by all those empty-calorie foods Americans eat, such as refined sugars and separated fats. In the acid attack on bone, the beef therefore is not so much with meat, as with grain and empty-calorie foods.

Nevertheless, Heaney may prove to have been prescient in predicting that “it is virtually certain that [the article by Sellmeyer et al] will be used by some to ‘prove’ that animal protein is positively harmful.” But if some do so, it will be because they failed to recognize that our findings speak only to the ratio of animal to vegetable foods consumed, as indexed by the ratio of animal to vegetable protein in the diet, and not specifically to the absolute amounts of animal food or protein consumed. Our hypothesis is that the ratio of NEAP is a risk factor for bone loss and hip fracture. In our study, the ratio of animal to vegetable protein consumed was used as a surrogate for that risk factor because animal foods are richer in acid precursors than in base precursors and because many vegetable foods are richer in base precursors than in acid precursors (2). It would not be inconsistent with our findings or hypothesis if large increases in total animal protein intake above the range consumed by our subjects reduced rates of bone loss and fracture if those increases were accompanied by appropriate increases in the intake of vegetable protein in the form of high-base-yielding plant foods.

Heaney also takes us to task for teaching the myth that sulfuric acid yields are higher from animal than from vegetable protein. That chastisement reflects an uncritical read of our paper, however, because we neither asserted nor implied such differential acid yields. Indeed, we are on record for taking pains to disabuse followers of that myth, to the extent of even supplying a table showing overlapping values of potential sulfuric acid yields for a wide variety of animal and plant foods (per gram protein) (5). Moreover, any differences in animal compared with vegetable yields of sulfuric acid that might be obtained are only part of the picture. Another part of the picture is the differential animal and vegetable yields of bicarbonate from nonprotein constituents of the food. Many plant foods (eg, roots, tubers, leafy green vegetables, and fruit) are richer per gram protein in such bicarbonate precursors than are animal foods (2). As an index of the NEAP, the ratio of animal to vegetable protein consumed in whole-food diets reflects the differential animal compared with vegetable yields of bicarbonate as well as those of sulfuric acid.

Heaney contends that our findings are at odds with reports of a positive relation between animal protein intake and skeletal health, specifically citing the Framingham Osteoporosis Study by Hannan et al (6). However, the focus of our article was the association of the rate of bone loss (and hip fracture) with the ratio of animal to vegetable protein consumed, whereas Hannan

Dietary ratio of animal to vegetable protein and rate of bone loss and risk of fracture in postmenopausal women

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By referring to the American diet as “protein-rich,” and linking dietary protein’s acid yield to bone damage, [the arti-
et al did not test for that association, and the reduced data set they reported does not permit such testing. The only other reported study we know of that specifically examined the potential association of the ratio of animal to vegetable protein intake and skeletal health is a cross-cultural study by Frassetto et al (5), the results of which are consistent with those of our study.

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REFERENCES


Reply to A Sebastian et al

Dear Sir:

The letter by Sebastian et al provides important clarification and reinforcement concerning a topic that, at least in certain segments of the general public, is highly contentious. I am particularly pleased to see the public comment piece excerpted by Sebastian et al, which makes all the essential points and, additionally, makes the crucial distinctions that are so often ignored in the popular nutrition community. It is important to have a group as distinguished as that of Sebastian et al weighing in on this side of the issue.

Their hypothesis, concerning the ratio of animal to vegetable foods, although plausible, is still just an hypothesis. It will be difficult to test convincingly. Moreover, as I noted in my editorial, the fact that the bone mineral density of the subjects at entry into the study was not lower for those with high dietary animal-to-vegetable protein ratios does not support their hypothesis.

My major concern, reinforced by extensive interaction with popular science and nutrition journalists, lies in the distraction from the importance of maintaining a high calcium intake. Negative effects on calcium retention of an acid residue diet occur principally in those with low calcium intakes, simply because many such individuals are already adapting maximally to the stress of low intake and have no further capacity to augment absorption efficiency to offset additional renal losses. Clearly, more work needs to be done in this area of nutrient-nutrient interactions.

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