

Protein, Calcium and Bone Density, Part 2

G. Douglas Andersen, DC, DACBSP, CCN

Last month, we investigated how protein and calcium can affect bone density, and reported that for every gram of protein consumed, we excrete one to 1.5 mg of calcium. We saw studies showing higher protein intakes correlated with lower fracture rates, and we postulated that high protein is more likely to affect those with lower dietary calcium. This information is supported by two studies published in the *American Journal of Epidemiology*.

Meyer, et al., found that protein increased the rate of hip fractures in elderly persons when their total calcium consumption was under 400 mg per day.¹ Feskanich, et al., published a paper that showed an increase in the amount of forearm fractures in pre-menopausal women with higher protein diets when total dietary calcium was below 540 mg per day.² This month, we will review a major study on how calcium, vitamin D and protein can influence bone health.

The Study

Three hundred eighty-nine men and women over the age of 65 began this trial three years ago,³ and 342 completed it (161 men and 181 women). Half of the subjects received 500 mg of calcium and 700 IU of vitamin D daily, while the others received placebo pills. Dietary intakes were estimated using food frequency questionnaires. All subjects received periodic bone mineral density measurements, along with calcium absorption studies, blood tests and urine tests. Those people who took the calcium supplements had an average intake of 1,346 mg of calcium per day (plus or minus 358 mg). The placebo group's mean calcium intake was 871 mg per day (plus or minus 413 mg). Protein intake was divided into groups of low, medium or high.

Figure 1:
Protein percentage of total calories.*

Dietary Protein Level		
Low	Medium	High
12.5	16.5	23.5

*Ranges in the original paper were averaged by Dr. Andersen.

Results

Bone density in the nonsupplemented group decreased. Although the percentages did not reach statistical significance, there was a linear correlation between the amount of total bone mineral density loss and the amount of protein ingested. That is, the higher the dietary protein (animal or vegetable), the greater the bone loss.

Results of the group who received the calcium and vitamin - D supplements were as follows: The low-

protein group lost bone density (but less than the low-protein placebo group). The medium and high-protein groups gained bone density, and there was a linear correlation between the amount of total bone mineral density gain and protein ingested. In this case, the higher the dietary protein (animal or vegetable), the greater the bone gain.

Comment

This is a classic example of the importance of studying macronutrient and micronutrient interactions and how they affect human health. This study left us with some interesting information, as well as an unanswered question: Since protein increases calcium loss, why would a high-protein diet elevate bone density in the calcium/vitamin-D group and decrease bone density in the placebo group? Researchers were unable to answer this unexpected finding. Fiber, phosphorous, magnesium and insulin growth factor I (IGF-1) were all ruled out as potential influences. The authors did not notice any interaction between protein and the gut's ability to absorb calcium when comparing the high and low calcium and protein groups. Clearly, bone health involves more than just calcium, protein and vitamin D. Other minerals, such as boron, silicon and manganese may be part of the answer, as are other vitamins, such as K and C. There are also a host of hormonal factors that could be causing this paradox.

In conclusion, although the mechanism is unknown, it is clear that high-protein diets can cause either bone loss or bone gain, depending on the amount of calcium and vitamin D ingested. The "take-home" message to all of our patients on high-protein diets is to make sure they get plenty of calcium and vitamin D. I am looking forward to further research in this area and, hopefully, the paradoxical relationship between protein and bone density will soon be explained.

References

1. Meyer HE, Pedersen JI, et al. Dietary factors and the incidents of hip fracture in middle-aged Norwegians. *Am J Epidemiol* 1997;145:117-23.
2. Feskanich D, Willet WC, et al. Protein consumption and bone fractures in women. *Am J Epidemiol* 1996; 143:472-9.
3. Dawson-Huges B, Harris SS. Calcium intake influences the association of protein intake with rates of bone loss in elderly men and women, *Am J Clin Nutr* 2002;75:773-9.

G.Douglas Andersen,DC,DACBSP,CCN
Brea, California
gdandersen@earthlink.net

NOVEMBER 2002