The Etiology of Osteoporosis: Bones of Contention!

By Dr John H Maher

It has been recognized for decades that vegetarians have a lower incidence of osteoporosis.[1] The Dietary Approaches to Stop Hypertension (DASH) trial is one of several epidemiological studies that found higher intakes of fruits and vegetables, particularly those rich in potassium, are associated with higher bone mineral density (BMD) and lower risk of fracture in older adults. Fruits and vegetables are rich in several nutrients that appear to play important roles in bone health, including potassium, magnesium, phytonutrients, antioxidants, bicarbonate ions and vitamin K.[2]

Boning Up on Osteoporosis

Osteoporosis is defined as having a bone density of more than 25 percent below the average of young adults of the same sex and race; bone density 10 percent to 25 percent below the average level is termed *osteopenia*, and reflects a milder degree of bone loss than osteoporosis.

Osteoporosis is the chronic loss of bone mass and strength. It afflicts over 8 million Americans; 1.5 million are subjected to life-threatening fractures every year. Currently, about 10 million North Americans have been diagnosed with osteoporosis; an additional 18 million North Americans have osteopenia and face a high risk of bone fracture or related complications. Direct medical costs related to osteoporosis exceed $14 billion per year. Of those who suffer hip fractures, some 20 percent die from complications within a year; 60 percent become dependent upon constant help in their daily lives.[3]

The accepted etiology of osteoporosis is related to sex hormone deficiency in menopause and andropause, suboptimal calcium and vitamin D nutrition, and lack of exercise. However, in spite of massive efforts over several decades, osteoporosis continues to remain an enormous clinical problem. The mechanisms through which hormone deficiency facilitates bone osteoporosis remain controversial. In this article, I will briefly present other possible co-etiologies we may want to consider more carefully in our practice recommendations.

Bone Matrix and Metabolic Acidosis

According to Dr. Susan Brown of the Osteoporosis Education Project, osteoporosis can be seen as a consequence of chronic metabolic acidosis, which robs us of our mineral reserves and impairs efforts to rebuild the **bone matrix**. She holds that the excess acid load promoting metabolic acidosis is acquired by:

1. dietary choices (excess protein, fat, phosphate/phosphoric acid and sulfate/sulfuric acid);
2. maladaptation to stress (distress-induced excess cortisol and adrenaline);
3. immune hypersensitivity (delayed allergy) reactions. [4]

She explains that bone responds to an acid load by dissolving its basic buffering mineral salts, calcium, magnesium, sodium, potassium and zinc, plus its citrate and carbonate stores. The body routinely buffers acids first with sodium and potassium (if reserves permit), then with a corresponding loss of calcium, magnesium and other minerals, as available. The buffering needed for one can of phosphoric acid-rich cola is the same amount of buffering capacity found in four Tums tablets![5]

According to Dr. Brown, in most individuals, the source of net acid load is from the metabolism of protein (when protein consumption exceeds 60g/day) and long-chain fatty acids (when they comprise more than 20 percent of calories in the diet). These must be neutralized by matching buffering elements from K+ and other mineral salts in fruits, vegetables, lentils/pulses, herbs and spices.[6]

Firing Up Old Bones?

Emerging clinical and molecular evidence suggests **inflammation** also exerts significant influence on bone turnover, inducing osteoporosis. Numerous pro-inflammatory cytokines have been implicated in the regulation of osteoblasts and osteoclasts, and a shift toward an activated immune profile has been hypothesized as an important risk factor. Chronic inflammation characteristic of aging, called "inflamm-aging," may be a determinant pathogenic factor.[7]

Interestingly, phenols are powerful phytonutrients that protect plants from oxidative damage and perform the same function for humans. Blue, blue-red and violet colorations seen in berries, grapes and purple eggplant are due to their phenolic content. Bilberries, for example, are high in phenolic anthocyanidins and are red in color. The outstanding phytonutrient feature of phenols is their ability to block specific enzymes that cause inflammation.[8]

Free Radicals: Rotten to the Bone?

Timothy Chambers and colleagues at St. George's Hospital Medical School in London have demonstrated that estrogen deficiency sensitizes cells to oxidant signaling and stress by lowering thiol antioxidants in osteoclasts. The authors write that bone loss is a consequence of not only estrogen deficiency, but also of other situations in which reactive oxygen species are involved, such as aging and inflammation ("inflamm-aging" again). This mechanism provides novel opportunities for the development of potential osteoporosis therapies, the researchers say. [9]

Women's Health Weekly (October 2003) reported that the use of antioxidants is associated with decreased levels of bone resorption. "It is feasible that antioxidants may reduce the damaging effects of oxidative stress by reducing the up-regulated osteoclastic differentiation and enhancing the down-regulated osteblastic differentiation."[10]

Phytonutrients from greens, and fruits and vegetables of all colors, are among nature's most powerful and plentiful exogenous antioxidants.

Bone: The Matrix Revisited

Vitamin K is plentiful in most fruits and vegetables and is a critical substance for activating osteocalcin (a bone protein), which in turn is an essential component for binding calcium molecules to bone protein matrix. Low vitamin K levels correlate with demineralized bone, which is more susceptible to fracture and osteoporosis. This function may be more related to vitamin K2 than to K1, however.[11]

So, Are We Boneheaded?

It is well-known that less than 20 percent of all Americans eat the minimum of five servings a day of fruits and vegetables. Even less consume the more optimal 7-13 servings a day. Even more alarming, we consume dramatically smaller amounts of phytonutrients than previously believed!

A subclassification of phenol phytonutrients called anthocyanins (ACNs) are pigments responsible for the blue, purple and red colors of blueberries, plums, cherries and other fruits. Previous estimates suggested that the average person consumed between 185 milligrams and 215 milligrams of anthocyanins per day. Although cited extensively, those figures were compiled in the 1970s, when analytical techniques were not as advanced and dietary patterns were different from those of today. The latest findings, compiled by U.S. Department of Agriculture researchers, indicate the average person consumes just 12.5 mg of ACNs per day![12]

Got Greens?

In conclusion, it may well be that a "greener" diet, featuring much more fruits, vegetables, dark greens and spices dense in alkalizing minerals, phytonutrients, antioxidants, bicarbonate ions and vitamin K, is what most of us, and our patients, need to bone up on!

References

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