Dynamic Chiropractic

Osteoporosis: Primarily a Nutritional Issue?

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We have been relying on the theory that if we can prevent the rate of bone turnover and keep calcium available for absorption, osteoporosis can be avoided. This is the calcium theory of osteoporosis. However, maintaining healthy bone is not that simple; if it were, then populations that consumed the most amounts of dairy and calcium supplements would have lower rates of osteoporotic fractures than the populations that consumed less dairy and calcium supplements. This has not been demonstrated; in fact, the opposite appears to be the case.

Countries that consume the most dairy and calcium supplements have the highest rates of hip fractures: the United States, Australia, New Zealand, and western European countries. The countries with the lowest rates of hip fractures (in Asia and Africa) consume little or no milk, dairy or calcium supplements. These data come from epidemiological surveys conducted worldwide by different research teams over the course of 20 years.

Osteoporosis is a complex, multi-factorial condition characterized by reduced bone mass and impaired micro-architectural structure, leading to an increased susceptibility to fractures. Bone strength is genetically determined, but other factors are involved, including environmental, nutritional and lifestyle factors.

Function of the Skeletal System

Support: The skeleton holds the body up, the mandible supports the teeth, all the bones provide support for the muscles, and many bones offer support for the organs directly or indirectly.

Protection: The skeleton encloses the brain, spinal cord, lungs, heart, organs in the pelvis, the viscera, and bone marrow.

Movement: The skeleton gives the skeletal muscles a platform for movement, locomotion, even respiration.

Blood Formation: Red bone marrow is the major producer of blood cells and cells of the immune system.

Electrolyte Balance: The skeleton is the body's main mineral reservoir, storing calcium and phosphate, and releasing them according to physiological needs.

Acid-Base Balance: Bone buffers the blood against excessive pH changes by absorbing or releasing alkaline mineral salts.

Nutrition is an important modifiable factor in the development and maintenance of bone mass and the prevention and treatment of osteoporosis. Most of the bone mineral content is comprised of calcium and phosphorus. The other dietary components, such as protein, magnesium, zinc, copper, iron, fluoride, and vitamins D, A, C, and K, are required for normal bone metabolism.

Dietary Ca requirement is determined mostly by skeletal needs, and it exerts a threshold behavior. This means that the skeletal response (in this case, skeletal accretion) will occur only when Ca is increased from the deficiency level to a threshold zone. Adding more Ca when the level of dietary intake already exceeds the threshold will not likely improve bone mass.

The Ca threshold for adults is approximately 1,100 mg. Therefore, typical baseline Ca intake becomes important when evaluating the literature for efficacy of dietary Ca on bone. For example, if baseline intake is already at the threshold level, additional Ca would not be expected to improve bone.

Understanding the interaction between different factors associated with bone health is still a work in progress. Fortunately, enough information is available to make reasonable progress in the prevention and management of osteoporosis. Let's look some of the issues with regard to this condition:

- With prolonged life expectancy increasing the elderly population, predictions are that osteoporotic fractures will reach epidemic proportions.
- Osteoporosis is a multifactorial disorder. Besides the influence of heredity, bone health depends on a whole range of nutrients and foods as well as the environmental factors; understanding the interactions of these nutrients among themselves and interactions with pharmacological, environmental and lifestyle factors is crucial for prevention and management of osteoporosis.
- Prolonged deficiency or excess of one or a combination of several nutrients, as well as changes in requirements of some nutrients due to physiological and/or metabolic circumstances, need to be factored into the osteoporotic problem.

Nutrition is one of the important modifiable factors in the development and maintenance of bone, and the prevention and treatment of osteoporosis. The nutrients of most obvious importance to bone health are calcium and phosphorus; they compose 80 percent to 90 percent of the mineral content of bone. Protein is incorporated into the matrix of the bone for collagen structure upon which the mineralization occurs. Other minerals and nutrients are crucial in carrying out the reactions and metabolic processes in bone. It is beyond the scope of this article to discuss all the factors involved in bone health; but what is possible is to illuminate some the key issues involved in the maintenance of bone health.

We all know that bone is a dynamic structure and that it is continually remodeling. It has many functions, some of which are obvious: support for the body, protection of fragile organs and a platform for the attachment of muscles for locomotion. Of course, the bone marrow is the main source for blood cells and cells of the immune system; but it is also a reservoir for minerals that the body needs to regulate electrolytes, and buffers the blood against pH changes.

Let's consider the last two functions of bone, electrolyte balance and acid-base balance, which are very dynamic activities requiring constant monitoring and management for the survival of the organism. The main electrolytes in the blood are sodium, potassium, calcium, magnesium, chloride, phosphate, and carbonate. Most commonly, problems occur when the level of sodium, potassium, or calcium is abnormal.

The source for these electrolytes is from ingested food, but if they are not available when needed,

bone is where the body will retrieve calcium and phosphate electrolytes. Similarly, the pH of the blood must be maintained in a narrow range between 7.35 pH to 7.45 pH. Chloride (Cl) and bicarbonate (HCO3) play a major role in maintaining acid-base balance, with bicarbonate being by far the most important buffer. Calcium forms an important blood buffer as ionized calcium bicarbonate. Again, if calcium is not found in sufficient amounts in food sources, bone is the body's resource for the needed calcium.

Because of these very important functions calcium plays in the balance of electrolytes and pH balance, osteoporosis appears to be more a problem of calcium homeostasis. This calcium homeostasis is of course affected by diet. It is known that increasing dietary protein increases urine calcium excretion. For every 50 g increment of protein consumed, an additional 60 mg of urinary calcium is excreted. It follows that the higher the protein intake, the more urine calcium is lost and the more negative calcium balance becomes.

Since 99 percent of the body's calcium is found in bone, with high consumption of protein there is an associated result of increased bone resorption. With increased bone resorption, increased prevalence of osteopenia results. But we also know that low-protein diets interfere with intestinal calcium absorption and IGF-1 levels. Epidemiological studies demonstrate a positive association between protein intake and BMD (bone mass density). On the other hand, there are many epidemiological studies that report higher fracture rates in groups consuming a high-protein diet. Overall, it appears that both low- and high-protein diets are detrimental to bone health.

With regard to whole foods containing multiple nutrients, the situation becomes even more complicated. The acid or alkali ash generated by the diet affects bone by altering acid-base status of the blood. It has been known since the late '60s that the skeleton serves as a buffering system for neutralizing acid or alkaline challenges from food and maintaining constant pH of blood.[3] Bone undergoes increased resorption in order to release calcium to neutralize metabolic acidosis. Therefore, acid ash-producing foods like meats, especially when consumed over a long period of time, contribute to the depletion of calcium, increasing the risk of osteoporosis, as opposed to fruits and vegetables with an alkaline ash.

In summary, we know that osteoporosis is a multifactorial disorder and that nutrition plays an important role in bone health. Calcium homeostasis is adversely affected by high-acid-ash diets. Our understanding of nutrients and other components affecting bone health continues to improve, but this knowledge is far from complete. As the information becomes available, we need to continue to keep up to date. Osteoporosis is one disorder that can be managed with appropriate nutrition.

Hip Fracture Incidence (HFI) by Country

HFI	Country	HFI per 100,000 Person-Years
Lowest	Nigeria	0.8
	China	2.9
	New Guinea	3.1
	Thailand	5.0
	South Africa	7.7
	Korea	11.5
	Singapore	21.6

	Malaysia	26.6
	Yugoslavia	33.5
	Saudi Arabia	47.3
	Chile	56.8
Middle	Italy	57.2
	Holland	60.7
	Spain	65.1
	Japan	67.3
	Hong Kong	69.2
	Israel	75.5
	Ireland	76.0
	France	77.0
	Finland	93.5
	Canada	110.3
	Crete	113.0
Highest	United Kingdom	116.5
	Portugal	119.8
	United States	120.3
	Australia	124.8
	Switzerland	129.4
	New Zealand	139.0
	Argentina	147.8
	Denmark	165.1
	Sweden	172.0
	Norway	186.7
	Germany	199.3
Lowest tertile	mean ± SD	19.7 ± 18.4
Middle tertile	mean ± SD	76.8 ± 18.1
Highest tertile	mean ± SD	147.3 ± 27.8

SOURCE: Frassetto LA, Todd KM, Morris RC Jr, Sebastian AJ. Worldwide incidence of hip fracture in elderly women: relation to consumption of animal and vegetable foods. *Gerontol A Biol Sci Med Sci*, October 2000;55(10):M585-92.

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