Potassium:
The Hidden Bone Guardian

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Potassium is a mineral of great importance to the body. In fact the adult "Adequate Intake" or AI for potassium at 4,700 mg is nearly four times that of calcium (at 1,200 mg). While it is widely known that potassium serves along with sodium to maintain critical fluid balance within the body, its role in bone health is less well appreciated.

The body has its own system of priorities for ensuring survival. Maintaining proper fluid balance inside and outside of the cells is indeed a high priority. The maintenance of systemic acid-base (pH) homeostasis is also held in very high priority, as alterations in blood pH balance can result in death within minutes. As the body produces various acids through its metabolic processes, there is a need to neutralize or buffer these acids with alkali (base) compounds. To ensure acid-base balance, the body maintains diet-derived alkali reserves in the blood, other fluids, and tissues. In addition, bone stores extra back-up alkali reserves available for transfer into the blood when alkali compounds in the blood, other fluids, and tissues run short.

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Bone, and the hydration layer around bone, provides the only substantial extra reservoir of base available to titrate excess metabolic acids. When we exhaust all other available alkali reserves, alkalizing compounds are drawn from in and around bone. This drain of alkalizing compounds from bone leads in turn to enhanced bone breakdown and loss of both bone mineral and bone matrix.

The role of potassium in bone health relates to the ability of selected potassium salts to neutralize bone-depleting metabolic acids. As discussed in previous E-Bone Health Newsletters, metabolic acidosis "eats away" at bone much like acid rain eats away at a limestone statue. Metabolic acidosis, however, is largely neutralized by potassium compounds, and to a lesser degree, by magnesium compounds obtained from fruits and vegetables.

Fruits, vegetables, seeds, and most spices contain high amounts of potassium compounds. These potassium compounds (known as potassium salts) include alkalizing forms of potassium such as potassium citrate, potassium malate, and potassium gluconate. Within the body these potassium salts are metabolized to yield potassium bicarbonate, which in turn provides the body with bicarbonate for neutralizing metabolic acids.[1] If these mineral salts are not consumed in adequate amounts, alkalizing bone mineral compounds are drawn upon to help reduce low-grade metabolic acidosis, causing increased bone resorption and enhanced loss of minerals in the urine.

A variety of population-based studies now document the positive association between high intake of base-forming potassium and magnesium foodstuffs and bone health. For example, several studies with adults have found a positive association between fruit and vegetable intake and bone mineral density.[2-5] In addition, urinary potassium, as a marker of potassium intake, is positively associated with bone mineral density in children.[6] Overall, a beneficial effect on bone mass from high potassium fruit and vegetable intake has been shown in both pre-menopausal and post-menopausal women, men, children, and the elderly.[7-8]

By neutralizing metabolic acids, potassium conserves calcium within the body and reduces urinary calcium loss. Potassium bicarbonate supplements equivalent to that found in 7-8 servings of fruits and vegetables were found to reverse the urinary calcium loss induced by high salt intake.[9] Along the same lines, the Dash Intervention Trial found that simply increasing fruits and vegetables from 3.6 to 9.5 servings per day decreased urinary calcium loss from 157 mg

per day to 110 mg per day.[10] Looking at it another way, bone health expert Dr. Robert Heaney explains that eating one medium baked potato or one large banana can conserve about 60 mg of calcium within the body. To put this into perspective, a urinary loss of an extra 60 mg calcium per day would result in an 18 to 21% loss of total skeletal calcium over a decade.

Further, drs. Sebastian, Frassetto, and colleagues at the University of California were able not only to decrease urine calcium and phosphorus loss, but also able to decrease bone breakdown and stimulate new bone formation in postmenopausal women by adding enough alkalizing potassium salts to neutralize metabolic acids.[11]

Fruits and vegetables provide mineral salts with alkalizing compounds (such as potassium citrate) useful for neutralizing net endogenous acid. In addition to promoting an alkaline environment, a diet high in fruits, vegetables, and legumes provides nutrients such as vitamins C, E, A, and the B's, quercetin and many other phytochemicals, which also promote bone health. Increasing vegetable and fruit intake is the preferred way to increase potassium intake and carries multiple benefits for blood pressure normalization, stroke risk reduction, and weight control in addition to being bone protective.

The current U.S. AI recommendation for potassium is 4,700 mg/day (the equivalent of about 13 half-cup servings of fruits and vegetables a day). The average adult daily potassium intake in the U.S. is much below the AI and is reported to average around 2,200 mg for women and 3,200 mg for men.

Unquestionably potassium is one of the most important key bone nutrients and consuming the recommended amount of 4,700 mg a day should be a top priority for everyone. See the Potassium Foods Chart for a list of wholesome food sources of potassium with the amount of potassium per serving. ◙

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Wholesome Food Sources of Potassium (with mg/serving)

FOOD	Portion Size	Potassium (mg)
Fresh Vegetables		
Asparagus	½ cup	165
Avocado	½ cup	680
Bamboo shoots, raw	1 cup	805
Black-eyed peas, cooked	½ cup	414
Broccoli	½ cup	205
Carrot	1 medium	245
Carrot juice	1 cup	490
Celery	1 stalk	270
FOOD	**Portion Size**	**Potassium (mg)**
Corn	½ cup	136
Fava beans, cooked	½ cup	215
Great Northern beans, cooked	1 cup	374
Iceberg lettuce, raw	½ head	425
Kidney beans, cooked	½ cup	314
Kelp	1 oz.	1,500