Bone health *From Healthyfiles.com 6/2012*

Acid-alkaline balance — is your diet the key to healthy bones?

by Dr. Susan E. Brown, PhD

There's a very simple approach to improving the health of your bones that practitioners here in the US have overlooked for almost a century now. It's available to anyone, it's natural, and it's not even terribly expensive — you don't even need health insurance to use it. That's because the approach is based on understanding our internal chemistry, specifically our pH balance, and learning how to make nutritional and lifestyle choices to keep our pH in the optimal range. If your high school chemistry class seems like it happened a century ago, here's a quick refresher course. You may remember that pH is a measurement of the relative acidity or alkalinity of a solution. pH is determined by the amount of positively charged ions in the solution — in the form of free hydrogen (H+) — and is measured in a spectrum ranging from zero to fourteen, with acidic solutions at the low end of the spectrum (0), alkaline solutions at the high end (14), and neutral pH in the middle (7).

pH basics*

The term pH literally means *potential for hydrogen*. It's used to designate the concentration of hydrogen ions in a given fluid. The more hydrogen ions, the more acidic the fluid is. Here are the fundamentals:

- pH is measured on a logarithmic scale of 0 to 14.
- 7 is neutral — neither acidic nor alkaline.
- Anything above 7 is considered alkaline or "basic."
- Anything below 7 is considered "acidic."
- Blood pH must be tightly regulated between 7.35 and 7.45.
- pH of other bodily fluids varies more widely (urine pH, for example, can range between 4.5-8.0).**

* *The Acid Alkaline Food Guide*, p 11. ** *Minich and Bland, 2007*

So what does all this have to do with bone health? In the human body, there is a fairly narrow, slightly alkaline pH that's required for health. Although some of our bodily fluids are acidic (urine has a pH of about 6, and stomach acid is about 1), overall our tissues maintain a slightly alkaline pH of just above 7. Since there are many factors that can make us more acidic — we'll talk about them in a moment — the body is constantly monitoring and adjusting its acidity and alkalinity. And our bones are at the very center of this acid-alkaline dance! Our bones are the guardians of our pH balance, so if our pH is outside the proper range, our bones give up minerals to restore pH — literally sacrificing themselves.

Unfortunately, our modern lifestyle — most notably the standard American diet (which I like to call "SAD"!) — encourages *chronic low-grade metabolic acidosis*, a condition in which our body's pH is regularly, even continually, tilted toward the acidic end of the ideal range. The high levels of animal protein, sugar, and processed foods in the SAD all contribute to this acid burden. Even a slightly acidic state, if maintained for a long period of time, can put your health at risk, particularly when it comes to your bones.

It's true that as we age it's common for our organ function to become less robust, which is the number-one reason we become more prone to metabolic acidosis over time. But it's also clear that by making some simple changes in your diet and lifestyle, you can quickly and successfully shift the body away from a low-grade acid state back to an ideal balance. These simple choices will not only support the functioning of your organs overall, they can strengthen your bone health dramatically.

Let's take a closer look at how your bones maintain acid-base balance in your body, and how supporting your body's pH can make the difference to your bone health as well as healthy aging and longevity.

What pH means to your health *The body is alkaline by design, but acid by function.*

— Albert Szent–Gyögyi Nobel Laureate and discoverer of vitamin C

We evolved in an *alkaline* or "basic" mineral-rich ocean environment. Even today, as a lick of your blood, sweat, or tears will attest, our body's internal environment remains salty and alkaline. It's perfectly logical that our enzymatic, immunologic, and repair processes all function at their best in an alkaline environment.

At the same time, our everyday bodily functions produce a tremendous amount of acid. The molecular fuel we use to contract our muscles during intense exercise, for example, produces a build-up of positively-charged hydrogen atoms (protons), which makes us more acidic. In digesting sulfur-containing foods like animal proteins, we produce sulfuric acid as a metabolic by-product, and every time we breathe our lungs produce volatile carbonic acid, which is then exhaled. Even our detox, immune, and stress responses create substantial acidic by-products.

So the body has the minute-to-minute task of neutralizing or excreting all this acid, bringing itself back to the alkaline environment that's best for our cells. In fact, your life depends on getting it back into balance!
Many people find it hard to believe that small fluctuations in pH can have dramatic effects on our health. For blood pH, it helps to think of body temperature: we function best when our bodies maintain a temperature of about 98.6 degrees Fahrenheit. When that number goes up or down — even just one or two degrees — we feel unwell, and our body uses a host of mechanisms like shivering and sweating to reset the thermostat. With our blood pH, the range is held tightly between 7.35 and 7.45 in our arteries, and between 7.31 and 7.41 in our veins. If a shift of even 0.1 above this range occurs in the blood pH, the blood becomes unable to deliver adequate oxygen and protect us from disease.

What's an alkalizing mineral?
A note on biochemistry
When we speak of *alkalizing minerals*, understand that it is not really minerals themselves that alkalize, but the negatively charged anions attached to the minerals — like the citrate in potassium citrate, or the carbonate in calcium carbonate, or the ascorbate in calcium ascorbate. So I like to speak of mineral *complexes*, or *alkalizing mineral salts*. Most of these complexes are found in highest amounts in vegetables and some fruits, which are universally the best place to get them — even when it comes to calcium, the complexes found in leafy green vegetables such as bok choy are absorbed more readily than those in dairy foods. So when you hear those *Got Milk?* ads talking about the calcium you need for strong bones, understand that it's not really the calcium that matters most — and you'd do better to "get bok choy" in any case!
Likewise, we have several built-in mechanisms to regulate pH, involving our kidneys, lungs, and skin. The lungs help by excreting acids as carbonic acid, which is basically carbon dioxide dissolved in water, and they do this without much effort or input from us. Though diet plays no direct role in the lungs' excretion of acids, the kidneys' excretion of acids in our urine is directly influenced by what we eat. If we eat a lot of acidifying foods, the kidneys can quickly act to compensate for the imbalance by drawing on available sodium and potassium salts from the blood and tissues. But if this compensation goes on for a long period of time, the body is obliged to tap into our alkaline mineral reserves, or the delicate kidney tissue will be burned by the acids.

How your bones balance your blood — and more
The vast majority of the alkalizing mineral complexes in our bodies are stored in our bones, where they serve several purposes. They give our bones strength while maintaining a reserve for pH regulation of the blood and other bodily fluids should the need arise. Alkalizing or "basic" minerals serve to balance the effects of slight blood acidity. With even small variations in acidity, the body draws on these alkalizing reserves first from the blood, then from tissues such as muscle, and ultimately from the bone stores.
Thus, when our diets lack the mineral salts needed to alkalize acid-forming foods, our bone reserves will be tapped quite frequently. Over time, an imbalanced diet of refined foods with excess animal protein, few fruits and vegetables, and poor-quality salts can allow our bodies to slip into a state of mild acidosis. Chronic stress, excessive or insufficient exercise, and environmental toxins also contribute to this acid burden. Over the long term, this continual acidosis requires more and more of our mineral reserves to be drawn from the bones and used to restore our pH.
And it doesn't take much to start this process. *Osteoclasts* (bone breakdown cells) are very sensitive to small changes in pH. In fact, it has been shown that a mere one-tenth of a drop in blood pH greatly stimulates our osteoclasts, inhibits *osteoblasts* (bone-building cells), and induces a bone mineral loss.

Sources of chronic, low-grade metabolic acidosis*
- Diet
- Distress (excess cortisol and adrenaline)
- Delayed immune system reactions (from delayed immune sensitivities or reactions).
- Environmental toxins

While this slightly acidic state isn't associated with obvious immediate symptoms, it can slowly lead to osteoporosis and other degenerative health disorders. For example, loss of sodium and potassium reserves can leave many women susceptible to blood pressure and other cardiovascular problems. Metabolic acidosis can also affect protein metabolism, which can result in muscle wasting and decreased cell, tissue, and organ repair. Accumulated acids lead to accelerated aging, increased free radicals, and impaired antioxidant activity. Acidosis may also increase your risk of kidney stones, fluid retention, imbalanced gut flora, and growth of yeast, fungi, and bacteria, which all thrive in an acidic environment.

The tax of modern living — **chronic low-grade metabolic acidosis**

Whether we know it or not, most of us are affected by a low-grade metabolic acidosis simply because we live in the modern world. Never before have our topsoils been so stripped, and our food supply chain as a whole been so devoid of minerals and other vital nutrients. And never before have we eaten a diet so high in animal proteins, sweeteners, and processed food with so few fruits and vegetables; been under so much chronic stress; or exposed ourselves to such a vast array of pollutants.

In terms of diet, most of our so-called modern conveniences are not helpful to our bodies' pH balance. High-protein power bars, ultra-caffeinated drinks, highly processed "fast" and "convenience" foods full of fillers and fats, refined flours and sugars — Mother Nature never imagined we'd abandon the generous, micronutrient-rich "Paleolithic diet" she provided, and now our bones are paying the price! Yet when we move back toward a diet like the one we ate for millions of years, full of whole fruits, vegetables, nuts, seeds, and spices, we can quickly ease a great deal of this burden, using food to our bones' advantage instead of their disadvantage.

Let's look at how this really works in our bodies with a can of cola. A simple 12-ounce can of cola has a pH somewhere between 2.8 and 3.2, but our kidneys can't excrete urine with a pH much lower than 5 without damaging the urinary tract. To process 12 ounces of cola to the point at which it can be excreted in the urine at a pH of 5, it must be diluted a hundred-fold, requiring that either the body must produce an additional 33 liters of urine (not likely to happen, since drinking enough water to make that much would be equivalent to drowning!), or a corresponding amount of buffer must be drawn from the body to neutralize the excess acid. This is a lot to buffer, and it's just one little can of cola! Now imagine the effects of a can a day (or more!) for 10 to 20 years.

Some alkalizing fruits and veggies*

For more foods, see our chart on the acid-alkaline food spectrum and my book, *The Acid-Alkaline Food Guide*.

Vegetables

- Sweet potatoes/yams
- Onion
- Garlic
- Asparagus
- Kale
- Arugula
- Endive
- Broccoli

Fruits

- Limes
- Nectarines
- Raspberries
- Watermelon
- Tangerine
- Pineapple
- Grapefruit
- Cantaloupe
- Raisins

* Brown, S., Jaffe, R. 2000. Acid-alkaline balance and its effect on bone health. *International Journal of Integrative Medicine, 2* (6), 7–18.

Keep in mind that food isn't the only culprit here. Many women are exposed to overwhelming amounts of stress that can also add to the acid burden and affect our bones. When we're feeling overwhelmed by work, getting little sleep, eating poorly, or even when our minds are whirling over some problem — the list can go on and on — our bodies release stress hormones known as adrenaline and cortisol. If this sort of stress impacts your life now and again, you can usually recover, but if this is your life all the time, it becomes damaging in the long run. Sustained at high levels, stress hormones can certainly tilt the body toward acidosis and otherwise deteriorate bone health.

But I have some good news for you — you can relieve a great deal of the acid burden in your bones by making some simple food choices.

Alkalize your diet — the Better Bones approach

Yes, I realize this may sound pretty "nut and crunchy" to a lot of you. But I want to share with you that in over 20 years of working with women at the Center for Better Bones, I've witnessed tremendous improvement in the bones of women who move toward an alkalizing diet. Though there are lots of other natural ways to strengthen bones and stimulate new bone growth, the alkaline diet is a simple, quick, and effective first step — and it will shore up your health on many other levels, too.

Classic studies tell us that the body can neutralize about 50 mEq (*milliequivalents*) of fixed metabolic acids per day from a "typical" intake of fruits and vegetables, without going into alkaline reserves. But unfortunately, the diet that most people in the US eat produces as much as 100 mEq per day — almost twice what the body can handle. This is because very few people in the United States population meet the fruit and vegetable serving recommendations (two to four servings of fruit and three to five servings of veggies, depending on age, gender, and activity levels). And these recommendations are the minimum — most people would be better off exceeding them and consuming 9–13 servings of vegetables and fruits a day. Here are ten simple dietary tips for shifting your body back into its alkaline comfort zone. You can also see the *Acid-Alkaline Food Guide* to see where some common foods fall on the acidalkaline spectrum.

 Eat more veggies and fruits. This is the most important step of all — even if you can get no further down the list than this, you can instantly make a huge difference to your bones. Plant foods contain abundant organic anions (negatively-charged "basic" particles) that combine with cations (positively-charged, or "acidic" particles) when metabolized, in turn reducing our net urinary acid load and naturally creating alkaline balance in the body. Again, keep in mind that the mineral deficits in our topsoil and water reduce the availability of minerals in the conventional food supply. If you want better bones, we suggest more than the standard "five-a-day" servings of vegetables, fruits, nuts, and seeds — nine to ten is better. As an aside, our perspective on plant foods follows the adage that "fruits are cleansing, vegetables are building" — fruits definitely have a place in the diet, but if you want to build bone, we suggest you focus on the veggies!

 Reduce soda intake, or eliminate it altogether. Clearly my example above should demonstrate why soda pop isn't good for your bones. Aside from the overwhelming amounts of sugar, high-fructose corn syrup, aspartame, or other chemicals of little to no nutritive value that soda contains, its high phosphoric acid content requires your body to sacrifice a great deal of alkaline buffering salts so it can excrete the acid without damaging your urinary tract.

 Replace refined carbs with tasty roasted roots, tubers, and gourds. Most grains are somewhat acid-forming — particularly when they are ground, bleached, and otherwise refined. Root, tuber, and gourd crops like sweet potatoes, yams, potatoes, parsnips, beets, carrots, squash and potatoes are super-rich in minerals that will alkalinize your blood, plus they're loaded with antioxidants and vitamins. So instead of eating pasta, pizza, pastry, rice or bread, try substituting with root crops a few days a week. While they are higher on the glycemic index than many other vegetables, they are satisfying and again, micronutrient-rich.

 Add fresh lemon and lime to your water. Though we typically think of citrus fruits as acidic, they're highly alkalizing in the body (limes especially). This is due to the conversion of citric acid to citrates on digestion. Help balance your acid load by squeezing a wedge of fresh lemon or lime into your water bottle or glass throughout the day. For that matter, get into the habit of giving your cuisine a squirt just before serving: lime is delicious on papaya, melons, salads, Mexican and Asian dishes, and lemon juice can really make a soup, curry or fish dish sing!

 Consider adding sea vegetables to your culinary repertoire. For some of you, I know this is "out of the question!" Others of you will have already adopted this practice at one point or another in your lives, or it may be part of your heritage. For others who are willing to try new things, why not experiment with packaged sea veggies available in the macrobiotics section of your health food store or Asian supermarket? Or, if you're lucky enough to live near a pristine beach, forage around and harvest a sample or two of your own. Consider the fact that just a hundred years ago, much of the seaboard here in Eastern North America was actively engaged in the harvesting of sea vegetables. While delicious seaweed dishes are still regularly enjoyed throughout much of Asia, it wasn't so long ago that many people on both sides of the Atlantic were also enjoying dulse, agar agar, and other mineral-rich seaweeds in soups, stews, and puddings (*blanc mange*).

 Drink 64 ounces of high-mineral spring water daily. So often our public drinking supply has been processed, stripped of the health-enhancing minerals water naturally picks up from the earth as it percolates through the ground. Then it's doctored with minerals like chlorine and fluoride which — despite conventional wisdom — are present at levels that many scientists feel are not healthy for teeth and bones. "Mineral waters" contain dissolved minerals and trace elements in widely varying amounts as they emerge from their sources in the ground. These include calcium, magnesium, and potassium salts, so it's an easy way to replenish your alkaline reserves. Since our diets are for the most part high in sodium, I'd avoid the ones that contain sodium unless you're living in a hot climate or working out and sweating a great deal. We like brands such as Essentia and San Pellegrino, but many people develop an allegiance to this or that label, so I'd encourage you to sample a few and find your own favorites.

 Reduce animal protein to 60 g or less per day. Animal proteins, which are high in the sulfur-containing amino acids cystine, cysteine, and methionine, are particularly acidproducing as your body metabolizes them. Protein is absolutely required for your bones and just about every other body tissue, but you can limit your animal protein sources (beef, chicken, pork, eggs, and dairy products) to 60 grams or less per day and upping plant-based protein sources. As recently as one or two generations ago people ate beans nearly every single day, sometimes at every meal, and in many places in the world legumes remain the number-one source of protein. Lentils in particular have a super alkalizing effect on the body compared to other protein sources, they cook more quickly than most other dried beans, they're versatile, and they're also more digestible for many people. Soy is another high-protein option you can try that's high in calcium and good for the bones.

 Add cinnamon, ginger, and other herbs and spices. Cinnamon is a wonderful alkalizing spice that you can add to just about anything. It's great with sweet potatoes, apples, or sprinkled in hot tea. Ginger root is a great alkalizer and detoxifier that spices up many dishes and makes a tasty, warming winter tea. Experiment with your spice cabinet — herbs and spices don't just make things taste better, in most cases they're good for your health.

 Monitor your urinary pH. Tracking your first morning urine pH (after at least 6 hours of sleep) is a simple and convenient way to keep track of how your nutritional changes are affecting your body. When this number is between 6.5 (slightly acidic) and 7.5 (slightly alkaline), it indicates that your overall cellular pH is likely where it should be — slightly alkaline. Results in an acid range can suggest that your bones are being depleted of minerals to offset the excess acid in your system. Super-sensitive and highly accurate, our own pH Test Kit is designed specifically to test either saliva or urine. See our pH Test Kit for my recommendations on tracking your pH.

 Supplement your diet with a high-quality multivitamin–mineral complex. No matter how attentive we are to what we eat, where it's grown or harvested, and how we dish it up, we just can't always have a perfectly balanced diet. You still have lots of options when it comes to making up for that fact of life, one of which is the peace of mind a topnotch bone-healthy supplement provides, like the ones we offer in our Personal Program for Better Bones. These formulations are designed to enhance pH balance through an alkalizing nutrient base, plus they provide a potent dosage of the key nutrients required for deep bone nourishment. Should your pH stay low after several weeks of this, you may have a greater need for alkalizing mineral complexes — so feel free to contact us for help.

Food is nature's best medicine

The direct relationship between acid-base balance and your bones reminds us of the fact that our bodies were meant to eat mineral-rich foods straight from the earth and sea. As we've moved away from a whole foods diet, we've seen increases in not just osteoporosis, but cancer, heart disease, and diabetes. Though many still believe that the food equation can be simply broken down to calories-in and calories-out, the micronutrients in our food speak actively with every cell in the body — including the osteoblasts and osteoclasts that make and break our bones daily. The Greek physician Hippocrates said that food should be our first and most important medicine. This is truer now in the 21st century than ever before. With a pill to pop for every ailment and all of the corresponding side effects, it's time for a new approach. If you are concerned with the strength of your bones, start here with an alkaline diet. We've helped women in all stages of bone health.

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