Chris Kresser

The Acid-Alkaline Myth: Part 1

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Many of you have probably heard of the 'alkaline diet'. There are a few different versions of the acid-alkaline theory circulating the internet, but the basic claim is that the foods we eat leave behind an 'ash' after they are metabolized, and this ash can be acid or alkaline (alkaline meaning more basic on the pH scale).

According to the theory, it is in our best interest to make sure we eat more alkaline foods than acid foods, so that we end up with an overall alkaline load on our body. This will supposedly protect us from the diseases of modern civilization, whereas eating a diet with a net acid load will make us vulnerable to everything from cancer to osteoporosis. To make sure we stay alkaline, they recommend keeping track of urine or saliva pH using handy pH test strips.

In this two-part series, I will address the main claims made by proponents of the alkaline diet, and will hopefully clear up some confusion about what it all means for your health.

Will eating an alkaline diet make you and your bones healthier?

Foods can influence our urine pH

Before I start dismantling this theory, I want to acknowledge a couple things they get right. First, foods do leave behind acid or alkaline ash. The type of 'ash' is determined by the relative content of acid-forming components such as phosphate and sulfur, and alkalis such as calcium, magnesium, and potassium. (1, 2) In general, animal products and grains are acid forming, while fruits and vegetables are alkali forming. Pure fats, sugars, and starches are neutral, because they don't contain protein, sulfur, or minerals.

It's also true that the foods we eat change the pH of our urine. (3, 4) If you have a green smoothie for breakfast, for example, your pee a few hours later will likely be more alkaline than that of someone who had bacon and eggs. As a side note, it's also very easy to measure your urine pH, and I think this is one of the big draws of the alkaline diet. Everyone can probably agree that it's satisfying to see concrete improvements in health markers depending on your diet, and pH testing gives people that instant gratification they desire. However, as you'll see below, urine pH is not a good indicator of the overall pH of the body, nor is it a good indicator of general health.

Foods don't influence our blood pH

Proponents of the alkaline diet have put forth a few different theories about how an acidic diet harms our health. The more ridiculous claim is that we can change the pH of our blood by changing the foods we eat, and that acidic blood causes disease while alkaline blood prevents it. This is not true. The body tightly regulates the pH of our blood and extracellular fluid, and we

cannot influence our blood pH by changing our diet. (5, 6) High doses of sodium bicarbonate can temporarily increase blood pH, but not without causing uncomfortable GI symptoms. (7, 8) And there are certainly circumstances in which the blood is more acidic than it should be, and this does have serious health consequences. However, this state of acidosis is caused by pathological conditions such as chronic renal insufficiency, not by whether you choose to eat a salad or a burger. In other words, regardless of what you eat or what your urine pH is, you can be pretty confident that your blood pH is hovering around a comfortable 7.4.

A more nuanced claim has been proposed specifically regarding bone health, and this hypothesis is addressed somewhat extensively in the scientific literature. It supposes that in order to keep blood pH constant, the body pulls minerals from our bones to neutralize any excess acid that is produced from our diet. Thus, net acid-forming diets (such as the typical Western diet) can cause bone demineralization and osteoporosis. This hypothesis, often referred to as the 'acid-ash hypothesis of osteoporosis,' is what I will discuss for the rest of this article. I'll address some of the other health claims in part two.

The kidneys – not bone – regulate blood pH

While more reasonable than the first claim, the acid-ash hypothesis seems to completely disregard the vital role the kidneys play in regulating body pH. The kidneys are well equipped to deal with 'acid ash.' When we digest things like protein, the acids produced are quickly buffered by bicarbonate ions in the blood. (7) This reaction produces carbon dioxide, which is exhaled through the lungs, and salts, which are excreted by the kidneys. During the process of excretion, the kidneys produce 'new' bicarbonate ions, which are returned to the blood to replace the bicarbonate that was initially used to buffer the acid. This creates a sustainable cycle in which the body is able to maintain the pH of the blood, with no involvement from the bones whatsoever.

Thus, our understanding of acid-base physiology does not support the theory that net acid-forming diets cause loss of bone minerals and osteoporosis. But just for argument's sake, let's say that our renal system cannot handle the acid load of the modern diet. If bones were used to buffer this excess acid, we would expect to see evidence of this taking place in clinical trials. Alas, that is not the case.

Clinical trials do not support the acid-ash hypothesis of osteoporosis

At first glance, some of the studies may look convincing, because higher acid diets often increase the excretion of calcium in the urine. Some researchers assumed that this extra calcium was coming from bone. (8) However, when calcium balance (intake minus excretion) was measured, researchers found that acid-forming diets do not have a negative effect on calcium metabolism. (9) Some studies found that supplementing with potassium salts (intended to neutralize excess acid) had beneficial effects on markers for bone health, which would tend to support the acid-ash hypothesis. However, these results were only observed in the first few weeks of supplementation, and long-term trials did not find any benefit to bone health from these alkalizing salts. (10)

Finally, even though the hypothesis holds that higher intakes of protein and phosphate are acidifying and therefore detrimental to bone health, multiple studies have shown that increasing protein or phosphate intake has positive effects on calcium metabolism and on markers for bone health. (11, 12) Summarizing the clinical evidence, two different meta-analyses and a review paper all concluded that randomized controlled trials do not support the hypothesis that acidifying diets cause loss of bone mineral and osteoporosis. (13, 14, 15)

So, it appears that neither physiology nor clinical trials support the acid-ash hypothesis of osteoporosis. But again, just for argument's sake, let's suppose that these trials are imperfect (which they are, of course; no science is perfect!), and thus we can't depend on their conclusions. If the acid-ash hypothesis of osteoporosis were true, we would expect to see an association between net acid-producing diets and osteoporosis in observational studies. Yet again, this is not the case.

Observational studies do not support the acid-ash hypothesis of osteoporosis

Observational studies have not found a correlation between dietary acid load and bone mineral density (BMD) or fracture risk, nor have they found a correlation between urine pH and BMD or fracture risk. (16, 17, 18) Additionally, higher protein intakes are correlated with better bone health in multiple studies, even though high-protein diets are generally net acid forming. (19) In fact, animal protein in particular (the most acid-forming food of all) has been associated with better bone health. (20, 21) Imagine that! One study included in a recent meta-analysis did find an association between higher protein intake and greater risk for fracture (22), but compared to the numerous more recent studies showing the opposite, this evidence isn't very strong. Overall, the acid-ash hypothesis of osteoporosis is not supported by physiology, clinical trials, or observational data.