Acid and Alkaline Foods: The Real Story

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Alkalizing foods are sometimes believed to be healthier because they prevent acid buildup in the body. This is a myth. [1-3]

Alkalizing foods such as vegetables, fruits and nuts are healthy: not because they prevent acid buildup, but because they contain more essential nutrients, fiber, and a healthy balance of carbohydrates and fats. [3]

Foods in the diet contain a variety of biochemicals and essential nutrients. Some foods are acid, some neutral, and some alkaline. During digestion, all foods are acidified by very powerful stomach acid. In the metabolic process, some foods such as meat, cheese, fish, and eggs generate acid (low pH). Other foods such as vegetables, fruits, and nuts cause alkalinity (high pH).

How your body manages pH

The pH of the blood and body organs is kept within very tight limits near 7.4 (between 7.35 to 7.45). This is accomplished by several mechanisms. The pH of blood and body organs is largely controlled by the level of carbonic acid (H_2CO_3), which is in equilibrium with the bicarbonate ion (HCO_3-). More carbonic acid in the blood plasma causes lower pH, and less carbonic acid causes higher pH. [4]

CO_2	⇔	$CO_2 + H_2O$	⇔	H_2CO_3	⇔	$H+ + HCO_3–$
(gas)		(dissolved)				

On the scale of seconds to minutes, pH is regulated by the rate of breathing. Faster breathing exhales more carbon dioxide from the lungs. Since carbonic acid in the blood is in equilibrium with carbon dioxide in the lungs, faster breathing removes acidity from the body, causing higher pH.

On the scale of hours to days, pH is also regulated in the kidneys by less or more excretion of bicarbonate and other ions such as ammonia, causing the urine to be more or less acidic. Acid urine is the natural consequence of eating foods that contain acid or generate acid in the metabolic process. Mountain climbers must breathe faster to get enough oxygen, but this causes their blood to lose carbonic acid and become more alkaline. Indeed, too alkaline. They must often rest at high altitudes for several weeks to allow their kidneys to secrete enough sodium bicarbonate to lower the pH to normal. [4,5]

> *While pathological relative acidity (pH ~7) is a problem, the healthy body carefully controls pH to keep it in the physiological range (~7.35 – 7.45). That includes the effect of acid foods and acid-causing foods. The body regulates blood pH by breathing faster (to increase pH), by breathing slower (to reduce pH) and by excreting acid or alkaline components into the urine to keep the pH within range. For example, when you consume ascorbic acid (vitamin C), the urine turns acidic but the blood will not. Yes, the ascorbic acid was absorbed into the body and bloodstream. But the blood nevertheless maintains a constant pH of 7.35- 7.45.*

The process of maintaining a nearly constant level of acidity is done automatically by the body. We may not always know why

we breathe faster or slower – there are a multitude of reasons – but one is to maintain a close control of blood acidity. It is not necessary to be concerned about acidity of the body or the urine when choosing foods to eat. Antacids taken to lower the acidity of the stomach will interfere with normal digestion and absorption of food, including magnesium, which is deficient in a majority of people who eat the "modern diet," especially the elderly. [6]

Cancer and acidity

Some have believed that eating foods that cause acidity can promote cancer because cancer thrives in an acidic environment. In the early 20th century, Otto Warburg and others found a correlation between cancer and low blood pH. We now know that cancer can thrive in a low-oxygen environment because it stops using the citric acid cycle and instead metabolizes sugar by fermentation, releasing lactic acid. It is now generally agreed that Warburg got the cause and effect in reverse. That is, many types of cancer thrive in low-oxygen environments (e.g. tumors without much blood supply) because they don't require oxygen to utilize sugar as an energy source. Then when the cancer releases lactic acid (which requires oxygen to be fully metabolized) the body pH goes down. The acid is an effect, not a cause for cancer. [7-9]

There may be some interaction between a low-oxygen environment and cancer, because when cancer cells are evolving due to mutations in DNA, the mutant cells in a tumor that thrive without oxygen are the ones that grow the fastest.

Other normal body cells can survive for a while without oxygen. For example, retinal photoreceptors in some animals go virtually anoxic every night and rely on fermentation of glucose. [10,11] They release lactic acid which the body very effectively counteracts to prevent the blood pH from going lower than 7.35. Muscle cells generate lactic acid in intense exercise because their need for ATP is greater than can be

supplied by the citric acid cycle. When lactic acid accumulates in the blood, we get “tired” and need some time to recover. The body accomplishes this by oxidizing the lactic acid with the citric acid cycle. [4]

However, the situation is more complicated than this. In a way, oxygen is a poison. Reactive oxygen species (ROS), oxidized molecules of many types, are a severe problem for all cells, and can cause genetic mutations in DNA. [12-14] Scientists of Warburg’s time didn’t know about all these details. Cancer was once thought to be one specific disease, but we now know that it is not one disease but many. There are thought to be many initiating factors, among them ROS, other toxins, and radiation. Some other types of mutation-causing mechanisms even originate within normal cells.

However, Warburg was correct in believing that toxins are a major cause of cancer, which in later stages can lead to pathological acidity in the body. And he was correct in believing that nutrients from vegetables in the diet are a big boost to the body’s recovery – and can help to prevent cancer and other progressive diseases. So in retrospect, his later emphasis on removing toxicity and supplying a healthy diet with lots of vegetables was correct. It just turns out that the diet heavy in vegetables is “alkalinity-generating.”

An excellent diet

An excellent diet can comprise a variety of foods including moderate portions of: high-protein foods such as meat, eggs, and fish; high-fat foods, including cheese, butter, nuts, avocados; small portions of starchy carbohydrates such as bread, pasta, sweet potatoes, and brown rice; a variety of colorful vegetables eaten raw such as tomatoes, carrots, radishes, peppers, salad greens; generous portions of cooked colorful vegetables such as winter squash, broccoli, Brussels sprouts, green beans, kale/collards; and fruits such as

oranges, cherries, berries, kiwi, peaches, and apples. The proportion of different foods may be important for individual choice or biochemistry.

Rationale for supplements

When served a portion of processed carbohydrates such as white rice, bread, or pasta, that is made from grain products that do not contain the original whole-grain components, it is prudent to eat only a small quantity and balance that with a portion of fat-containing food if possible. Then, take supplements containing the nutrients that were lost in the processing, such as magnesium, B vitamins, and vitamins C and E in adequate doses. And eat healthy portions of vegetables whenever possible.

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