Dynamic Chiropractic

NUTRITION / DETOXIFICATION

# Green Alkalizing pH Powders: pHacts of pHysiology

John Maher, DC, DCBCN, BCIM

> "For the cells of the body to continue living, there is one major requirement: The composition of the body fluids that bathe the outside of the cells must be controlled very exactly."
>
> *- Arthur C. Guyton,Function of the Human Body*

A healthy life requires balance: sympathetic/parasympathetic, *yin/yang*, too much tone/too little tone, insulin/glucagon, Th1/Th2, acid/base. The importance of achieving an alkaline/acid balance is familiar to many health professionals who pay attention to nutrition because of the book by Robert Young, PhD, *The pH Miracle*. Our own M.T. Morter Jr., BS, MA, DC, had earlier done much to present science-based testing methods to help patients establish a balanced pH.[1] Scientific investigation of the pH of foods goes back at least 100 years.[2]

pH Physiology

pH stands for *potential hydrogen*. (For you fellow science geeks, pH represents the negative logarithm of the hydrogen concentration.[3]) Certainly pH balance is integral to health. Although different bodily fluids and alimentary contents can have widely different pH levels, I am speaking specifically of the blood and the interstitial fluids when discussing acid/base balance, both of which are alkaline in pH.[4] In the office setting, urine and saliva pH are used for measurements. Dr. Morter's work, *pH Your Potential for Health*, is an excellent introduction and guide to such clinical testing.[5]

Acids are chemical compounds containing the element hydrogen that have the ability to supply positively charged hydrogen ions to a chemical reaction. Hydrogen ions stimulate our tongues and cause the sour taste. Conversely, alkalies, also called *bases*, form the ion -OH in solution. Most metabolic processes incur some kind of acid production. Exercise produces lactic acid and carbonic acid. Protein digestion produces sulfuric and phosphoric acid. Carbohydrate and fat digestion produce acetic and lactic acid.[6]

These acids are buffered by our "alkaline reserve." The macrominerals involved are sodium (Na), calcium (Ca), potassium (K) and magnesium (Mg). This family of alkaline minerals is called the *carbonic salts*.[7] Any of these carbonic salts can be symbolized as a group by *Ba*CO3. When carbonic salts meet sulfuric, phosphoric, acetic or lactic acids, they are buffered to make new salts as follows:

$$BaCO3 + H2SO4 = BaSO4 + H20 + CO2$$

*or*

Carbonic salt + sulfuric acid = sulfuric salt + water + carbon dioxide

Sulfuric salt, unlike sulfuric acid, is only slightly acidic and can be excreted without harm to the kidneys or colon. $CO_2$ is exhaled and the water is recycled or excreted.[8]

Several buffering compounds are dissolved in our plasma, namely $NaHCO_3$ and $Na_2HPO_4$ (alkaline sodium bicarbonate and phosphate) and $H_2CO_3$ (volatile carbonic acid). During exercise, which produces acids, we breathe deeply to expel $CO_2$. Increased respiration, which depletes $CO_2$, allows the blood to release more $CO_2$.

$$H_2CO_3 = CO_2 + H_2O$$

Basically, we use breath to expel volatile carbonic acids already present in our blood ($H_2CO_3$) to balance out the lactate and carbonic acids produced by exercise.[9] However, other reactions produce nonvolatile acids.

$$NaHPO_4 + HCL = NaH_2PO + NaCL$$

*or*

Alkaline sodium phosphate + hydrochloric acid = acid (dihydrogen) sodium phosphate + table salt

Acid phosphate is nonvolatile and cannot be exhaled away. Although it is a weak acid compared to HCL, it cannot be allowed to accumulate. This weak acid is safely excreted by the kidneys, leading to the normal acid pH of the urine.[10] If there is insufficient alkaline reserve, more alkaline minerals are provided by bone catabolism. Muscle minerals may also become suboptimal, leading to subjective stiffness and discomfort. Shortage of extracellular Na and Ca lead to suboptimal intracellular K and Mg, leading to muscle and nerve dysfunction. Severe acidosis will lead to coma and death.[11] (Conversely, severe alkalosis leads to titanic convulsions and death.[12]) To retard such a process, the body will use the abundant nitrogen from a high-protein, acid-ash diet to make ammonia, which is highly alkaline in nature.[13]

pH of Foods

A food is considered acid or alkaline by the ash it leaves after it is burned.[14] Generally, meat, fish and eggs leave the most acidic ash; grains less so. Most dairy products are more or less neutral, while fruits and vegetables tend to leave an alkaline ash.[15] A diet rich in acid-ash foods must be buffered with alkaline minerals. Any relatively weak, nonvolatile acids produced by such buffering are then safely excreted via the kidneys or bowels. If the alkaline reserve (mostly sodium and potassium) is depleted, calcium and magnesium are released from bone and muscle. If those efforts fail, nitrogen-rich ammonia is generated via the kidneys to neutralize the acids.[16] Therefore, the main reason that fruits, vegetables and greens are alkalizing is because they are rich in alkaline macrominerals (Na, K, Ca, Mg) and relatively low in protein.

The daily value (DV) for Na is 2,400 mg; K is 3,500 mg, Ca is 1,000 mg and Mg is 400 mg.[17] How much of each of the four macrominerals is present will have a lot to do with the focus of the greens product. If the focus of the formula is to supplement high-antioxidant phytonutrients, then the more important measure will be antioxidant capacity tests. In my opinion, the only way to get the phytonutrition-based antioxidant power of five to 10 servings of fruits and vegetables of all the colors in 8 to 12 grams of powder is to use high-antioxidant phytonutrient extracts and

concentrates from fruits, vegetables, herbs, teas and spices from all the colors.

By definition, one concentrates a group of compounds by excluding others. Therefore, in greens and super-fruit and super-vegetable juice powders that provide a proven high antioxidant value, all the water and most of the fiber, sugar, vitamins and minerals are excluded. If you can garner the data, you will find that most high-antioxidant greens and super-fruit and super-vegetable powders are very low in alkalizing minerals. This doesn't mean they are unhealthy or bad, not in the least; it just means they are not very alkalizing.

If you want to make alkalizing greens, you could use a lot of sea vegetables (high in salts), grasses, herbs, leaves, bark, roots, some vegetables, little to no fruits and no algae (which has too much protein). Taking a quick look at the nutritional analysis should reveal an abundance of organic Na and K, and Ca and Mg to a lesser extent. As the higher mineral concentration is hard to mask, the taste profile may suffer. Several servings a day with lots of water will often be indicated until the pH is determined to be balanced. This would be less likely to supply a balanced spectrum of high-antioxidant fruits and vegetables of all the colors, and antioxidant scores would probably not be very high.

Best of Both Worlds?

For those desiring both a broad and balanced spectrum of high-antioxidant capacity phytonutrients and a strong alkalizing drink, the key is to consider what you mix with the greens powder. Mixing in whey protein concentrates/isolates is acidifying. (Unprocessed whey straight from the cow has a more or less neutral effect on pH balance, as does milk, but whey-protein concentrates and isolates are acidifying, having much higher protein content and much fewer minerals than whole whey.) This does not mean whey is bad for you. Mixing a greens product with MSM (methylsulfonylmethane) will make it less alkalizing, as MSM is a rich, acidifying sulfur source. Mixing a greens powder with naturally high mineral-content water will add alkalizing minerals, especially sodium and calcium.[18]

A squeeze of potassium-rich lemon or lime will make it even more alkaline.[19] Another solution is to use orange juice. Many people mistakenly feel that orange and tomato juice are too acidic. Indeed, most fruits are rich in organic acids, like ellagic acid in raspberry and citric acid in citrus fruits. These organic acids are very good for us for a variety of reasons.

We do not determine the pH of a food product by putting in a pH stick. That works with water, but not foods. With foods, we are concerned with the ash left behind after metabolism. The ash of orange juice is rich in potassium and calcium, especially if fortified with calcium and vitamin D.[20] For those desiring less calories, a blend of half high-mineral-content water and half orange juice is a tasty option with which to mix a greens powder.

Find Out More

For those of you interested in monitoring pH in your patients, I again recommend *pH Your Potential For Health*.[1] For those of you who would like to find out more about the physiology of pH, consider some of the references listed at right.[21,22] I particularly recommend reading *Blood, Sweat, and Buffers: pH Regulation During Exercise*.[23]

*References*

1. Morter MT. *pH Your Potential for Health*. Morter Health Systems, 2000.

2. Sherman HC, Gettler AO. The balance of acid-forming and base-forming elements in foods, and its relation to ammonia metabolism. *J Biol Chem* March 1912.
3. What Is pH? General Chemistry Online. http://antoine.frostberg.edu/chem/senese/101/acidbase/faq/what-is-pH.shtml.
4. Morter, *op cit*, p. 4.
5. *Ibid*, pp. 1-4.
6. Aihara H. *Acid Alkaline*. Chico, Calif.: George Ohsawa Macrobiotic Foundation, 1986, pp.14-15.
7. *Ibid*, pp. 9-10.
8. *Ibid*, p. 10.
9. *Ibid*, p. 18.
10. *Ibid*. p. 19.
11. Anders JM. *A Textbook of the Practice of Medicine*. Philadelphia: WB Saunders Co., 1920, p. 410.
12. Anderson AK, Pritham GH. *Anderson's Essentials of Biochemistry*. St. Louis: CV Mosby Co., 1968, p. 532.
13. Aihara, *op cit*, pp. 19-20.
14. Sherman, *op cit*, p. 323.
15. *Ibid*, pp. 327-30.
16. Morter, *op cit*, p. 11.
17. *A Food Labeling Guide*. U.S. Food and Drug Administration, June 1999. www.cfsan.fda.gov/~dms/flg-7a.html.
18. Bottled water containing not less than 250 parts per million (ppm) total dissolved solids (TDS) may be labeled as mineral water. Mineral water is distinguished from other bottled waters by its constant level and relative proportions of mineral and trace elements at the point of emergence from the source. No minerals can be added to this product. If the TDS is below 500 ppm or greater than 1,500 ppm, the statement "low mineral content" or "high mineral content," respectively, must appear on the principal panel. If the TDS is between 500 and 1,500 ppm, no additional statements are needed.
19. Murray MT. *The Healing Power of Foods*. Roseville, Calif.: Prima Publishing, 1993, p. 367.
20. Sherman, *op cit*, pp. 327-8.
21. The Chemical Buffers. http://scifun.chem.wisc.edu/CHEMWEEK/BioBuff/BioBuffers.html.
22. pH Buffers Search. www.searching.uk.com/blood_buffers.html.
23. Casiday R. Frey R. *Blood, Sweat, and Buffers: pH Regulation During Exercise*. St. Louis: Department of Chemistry, Washington University. www.chemistry.wustl.edu/~edudev/LabTutorials/Buffer/Buffer.html.

DECEMBER 2008