What does it mean when you are told to alkalise?

A number of books and websites tells us we need to alkalise our bodies for optimal health. What does this mean? Is alkaline water a scam or does it really have health benefits?

Firstly, what is meant by pH, acidity and alkalinity?

pH refers to is the concentration of H^+ ions in a water solution. If the pH of a solution is 7, then there is a concentration of 1 H^+ ion per 10^7 water molecules. (That is, 1 H^+ ion per 10 million water molecules. To get an idea of how big 10^7 – 10 million millimetres is 10 kilometres.) A pH of 3 has a concentration of 1 H^+ ion per 10^3 water molecules.

Acids are water solutions that have a pH of less than 7, alkalis have a pH of greater than 7 and a neutral solution has a pH of 7.

A decrease of 1 pH correlates to a 10 times increase in acidity.

An increase of 1 pH correlates to a 10 times increase in alkalinity.

Alkaline Water

The pH of our stomach acids is around 3. Drinking slightly alkaline water is quickly going to be neutralised by our stomach acids.

What you can do is add ¾ of a teaspoon of baking soda (sodium bicarbonate) to a litre of water.

A study of young adults drinking about a 1 L alkalinised water a day dropped their LDL cholesterol by 10% over 2 months. [1]

Another study of older women showed a drop of nearly 15% of their LDL cholesterol. [2]

It is the sodium in the water that reduces the acid load on the kidneys.

Why is this important to our health?

The pH of blood must be within a very narrow range of 7.35 – 7.45. There are a number of different mechanisms to ensure that the blood pH is in the correct range. [3]

- Buffering systems – there are a number of different buffering systems. One system is carbonic acid – sodium bicarbonate buffer system. Even if a strong acid or alkali is added to this solution, the change to the pH is only small.

- Lungs
- Kidneys

If we eat foods that produce acid then our kidneys need to remove the excess. Over time, this causes considerable damage to our kidneys and overall health.

One way of estimating the load on our kidneys is burning the food and measuring the pH of the ash. This does produce some inconsistencies. Coffee is shown to be an alkalising food where it is an acid forming food. Another technique called PRAL (Potential Renal Acid Load) estimates the potential load on the kidneys by the content of the food. [4] [5]

Acid forming nutrients in foods

- Chloride
- Phosphorus
- Proteins – 2 amino acids that form proteins (methionine and cysteine) contain sulphur. Excess protein form sulphates after digestion that is acid forming. The level of these amino acids is greater in animal products than vegetable products.

Alkaline forming nutrients in foods

- Sodium
- Potassium
- Calcium
- Magnesium

Anion Gap Test

The anion gap test is a calculated value that is performed is a part of a biochemical pathology tests. It is calculated as the amount of sodium + bicarbonate – chloride ([Na] + [HCO3] – ([Cl]) in the blood.

It is used to determine how acid the blood is.

Normal range is 7-17 mmol/L. For the anion gap test, the units mEq/L and mmol/L are the same. This is not always the case.

A 1980 paper, [6], showed that an anion gap greater than 30 mEq/L was frequently due lactic acidosis or ketoacidosis. Lactic acidosis is caused by liver or kidney problems. Ketoacidosis caused by the production ketone bodies which can occur in type 1 diabetes or people on a ketogenic diet. 30% of those within the range 20-29 did not have lactic acidosis or

ketoacidosis. The paper studied the role of total proteins, phosphorus, potassium and calcium in accounting for acidosis. The conclusion was that, “the possibility of unidentified anions or unrecognized changes in the ionic equivalents of normal plasma constituents requires further consideration […]”.

This matches the PRAL assessment of dietary intakes which takes into account phosphorus, potassium, magnesium and calcium.

A high or rising value of the anion gap test is a cause for concern. However, the liver and the kidneys usually due a really good job of keeping the blood pH within the very narrow range of 7.35-7.45. As a result, the anion gap test will not show the impact of dietary intakes on pH because our bodies have already removed the electrolytes that are likely to cause an imbalance.

PRAL Food Table

The Potential Renal Acid Load (PRAL) measured in mEq/day, is calculated by the following formula.

- 0.49 * protein (g/d) +
- 0.037 * phosphorus (mg/d) –
- 0.021 * potassium (mg/d) –
- 0.026 * magnesium (mg/d) –
- 0.013 * calcium (mg/d)

Below is a table of selected foods and the PRAL values. The larger the number then the greater the acid load.

Group	Food	PRAL
Cereal Grains and Pasta	Quinoa	-0.2
	Rice, white, glutinous, cooked	0.9
	Oat bran, cooked	2.9
	Wild rice, raw	9.4
	Rye	12
	Wheat, durum	12.3
Dairy and Egg	Milk, goat, fluid	-0.5

Group	Food	PRAL
	Milk, whole, 3.25% milk fat	0.2
	Butter, whipped, with salt	0.4
	Cheese, ricotta, whole milk	6.2
	Egg, whole, raw, fresh	9.4
	Cheese, camembert	13.1
Finfish and shellfish	Fish, anchovy, European, raw	5.4
	Fish, cod, Atlantic, raw	6.5
	Fish, mackerel, Atlantic, raw	8.4
	Fish, tuna, fresh, skipjack, raw	9.2
Fruits	Figs, dried, uncooked	-14.1
	Dates, medjool	-13.7
	Avocados, raw, California	-8.6
	Bananas, raw	-6.9
	Rhubarb, raw	-6.5
	Kiwi fruit, (Chinese gooseberries), fresh, raw	-5.6
	Papayas, raw	-5.5
	Melons, cantaloupe, raw	-5.1
	Passion-fruit, (granadilla), purple, raw	-4.6
	Apricots, raw	-4.3
	Cherries,sweet, raw	-3.8
	Oranges, raw, Florida	-3.6
	Acerola, (west Indian cherry), raw	-3.1
	Nectarines, raw	-3.1
	Peaches, raw	-3.1
	Mangos, raw	-3
	Blackberries, raw	-2.8
	Plums, raw	-2.6
	Strawberries, raw	-2.5
	Pineapple, raw, all varieties	-2.3
	Pears, raw	-2.2
	Apples, raw, with skin	-1.9
	Blueberries, raw	-1
Legumes	Lima beans, large, mature seeds, raw	-18.3
	Beans, French, mature seeds, raw	-14.5

Group	Food	PRAL
	Beans, pinto, mature seeds, raw	-9.6
	Beans, great northern, mature seeds, raw	-9.1
	Beans, kidney, all types, mature seeds, raw	-8.4
	Beans, adzuki, mature seeds, raw	-6.7
	Beans, white, mature seeds, canned	-4.9
	Tofu, extra firm, prepared with nigari	3.5
Nuts	Nuts, pine nuts, pinyon, dried	-12.4
	Nuts, coconut water (liquid from coconuts)	-5.1
	Nuts, macadamia nuts, dry roasted, without salt added	-0.5
	Nuts, brazil nuts, dried, unblanched	8.1
	Nuts, pine nuts, dried	8.7
Pork	Pork, fresh, ground, cooked	12.4
Poultry	Turkey, all classes, skin only, cooked, roasted	10.5
	Chicken, roasting, meat only, cooked, roasted	13.8
Vegetables	Mushrooms, shiitake, dried	-20.2
	Beet greens, raw	-16.7
	Yam, raw	-15.1
	Spinach, raw	-11.8
	Potatoes, Russet, flesh and skin, baked	-8.6
	Kale, raw	-8.3
	Parsnips, raw	-5.9
	Carrots, raw	-5.7
	Pumpkin, raw	-5.6
	Broccoli, Chinese, cooked	-5.2
	Brussel sprouts, raw	-5.1
	Cabbage, Chinese (pak-choi), raw	-5
	Celery, raw	-5
	Seaweed, kelp, raw	-4.8
	Mushrooms, portabella, raw	-4.5
	Cauliflower, raw	-4.4
	Cabbage, red, raw	-4.3
	Mushrooms, brown, Italian, or Crimini, raw	-4.2
	Tomatoes, yellow, raw	-4.1
	Lettuce, red leaf, raw	-3

Group	Food	PRAL
	Asparagus, cooked, boiled, drained, with salt	-2.2

The United States Department of Agriculture PRAL List (exceprt)

Show more
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Note

- the PRAL calculation includes the amount of protein per day. This figure does not distinguish between high-sulphur containing proteins and low-sulphur containing proteins. It is the sulphur content that increases the acidity of the food item.
- PRAL is only an estimate of the load on the kidneys. The same foods can have different mineral contents depending upon growing conditions or even which side of the tree the fruit is picked from. We absorb only a proportion of the minerals that are in the food we eat.
- PRAL is not the only indicator of the value of the food.
- It is the total load on the kidneys of the food in a meal that is important – not the individual components.
- The PRAL values are based on 100g of the edible portion of food. Comparing 2 medium eggs (approximately 100g) with 100g of dried spice is not a realistic comparison.

Footnotes

1. Pérez-Granados, A. M. et al. (2010) Reduction in cardiovascular risk by sodium-bicarbonated mineral water in moderately hypercholesterolemic young adults. *Journal of Nutritional Biochemistry*. 21 (10), 948–953.
2. Schoppen, S. et al. (2004) A sodium-rich carbonated mineral water reduces cardiovascular risk in postmenopausal women. *Journal of Nutrition*. 134 (5), 1058–1063.
3. Guyton, A. G. (1976) *Textbook of Medical Physiology*. Philadelphia: W B Saunders Company.
4. Remer, T. et al. (2003) Dietary potential renal acid load and renal net acid excretion in healthy, free-living children and adolescents. *American Journal of Clinical Nutrition*. 77 (5), 1255–1260.
5. Remer, T. & Manz, F. (1995) Potential renal acid load of foods and its influence on urine pH. *Journal of the American Dietetic Association*.
6. Gabow, P. A. et al. (1980) Diagnostic importance of an increased serum anion gap. New England Journal of Medicine. 303 (15), 854–858.