ADVANCED (DE)HYDRATION ASSESSMENT – WHEN WATER ALONE IS NOT ENOUGH

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ABSTRACT

Water is perhaps one of the most overlooked nutritional deficiencies. Dehydration hinders performance starting at just 2-3% of body water weight loss while other symptoms, ranging from headaches to cramping, will soon follow if left untreated. Hydration is much more than having one drink when thirsty or drinking until the urine is a clear color. The amount of water a person consumes is only one piece of hydration. Electrolytes, glucose levels, stored glycogen, hormone levels, and small intestine, colon, and kidney function all have a major impact on the hydration of an individual. Advice to "just drink more water" is no guarantee to ward off dehydration and general manual muscle testing (MMT) with water alone tends to miss many problems associated with dehydration.

Key Words: dehydration, hydration, glycogen, renin, aldosterone, hyponatremia, electrolytes

INTRODUCTION

Often the kidneys are the focus when investigating fluid status, as they are the location where renin is produced, which eventually influences the thirst reflex in the hypothalamus via the renin-angiotensin-aldosterone axis. The effect on aldosterone will also lead to changes in sodium and consequently on fluid levels. One also tends to think that since urine is produced in the kidneys, they are a good indicator of hydration. If urine volume is low and very concentrated, this may be a sign of low hydration status. If an individual is urinating often and the color is very clear, then the thinking is that they are well hydrated. However, though often true, this is not necessarily always the case. Functional problems resulting from dehydration often occur long before urinary issues are seen. The kidneys have the ability to conserve or excrete excess water, but they are not the source of water absorption. To understand how well a person is absorbing fluid and holding onto the fluid, one must focus on the small intestine.

Water absorption occurs primarily in the small intestine (duodenum and jejunum) and its efficiency in passing through the intestinal lumen is greatly influenced by electrolyte levels as well as glucose levels.[1] Virtually no absorption occurs before this in the stomach. In addition to the average 1-2 liters of water consumed each day, another 6-7 liters of fluid is received by the small intestine each day from the salivary glands, stomach, pancreas, liver, and small intestine itself. Water absorption occurs by osmosis and this absorption is highly dependent on the amount of solutes present, primarily sodium, as well as glucose and other carbohydrate solutions. Small amounts of sodium added to water have long been known to increase gastric emptying and small intestine

absorption.[2] Certain hormones, such as aldosterone, as well as neurotransmitters, such as norepinephrine, can greatly influence electrolyte status in the intestine and therefore affect hydration.[3]

The presence of carbohydrates in water will also promote rapid uptake of water, provided the solution is not too dense. Up to an 8% carbohydrate (glucose/sucrose) solution is optimal for absorption, above that the amount of absorption appears to be hindered.[4] This is equivalent to approximately 20g of carbohydrates per 8oz water. Once the water is absorbed, glycogen levels as well as muscle mass play a major role in water retention.

DISCUSSION

The viscerosomatic relationship of the small intestine is to both the quadriceps and the abdominals. The nutrition associated with the small intestine is vitamin D and B complex for the quadriceps and vitamin E for the abdominals.[5] This author proposes that the body's most overlooked and vital nutrient, water, should always be investigated when there is a quadriceps and/or abdominal involvement related to small intestine dysfunction.

The theory that there are many people suffering from [functional] dehydration is not supported by testing water alone, which is the way it is so often done. A 2-3% water loss is very common and will affect physical and mental performance. Water must be tested in conjunction with a carbohydrate, (sugar or glucose polymers, such as maltodextrin), or with salt. Glucose plus fructose solutions tend to enhance water absorption,[6] while fructose solutions alone often hinder absorption because fructose is absorbed by passive (facilitated) diffusion in the gut (this often results in cramping in athletes). Performing the combined test will reveal many overlooked and undiagnosed cases of dehydration that often result in back, hip, and knee pain in patients due to the abdominal and quadriceps involvement.

An individual needs a certain amount of sodium in the body to retain water necessary for good health. If sodium concentrations drop too low, problems will arise. Though this can occur fairly often from a functional perspective, hyponatremia, defined as a serum sodium concentration of 135 mmol per liter or less, is often not diagnosed until the individual is far into the realm of impaired health and performance.[7] This is common among athletes and often results in too much fluid accumulating in the body as it cannot be absorbed efficiently. Many times athletes will complain of a "sloshy belly" as the water just sits in the stomach or upper small intestine. Likewise, if the salt is present and the water is not, a fluid imbalance will also occur, as water is pulled from other areas (typically extremity muscles) to aid in absorption. This will often result in muscle cramps and is the reason for becoming thirsty while eating salty foods.

An individual also needs glycogen to be properly hydrated. Approximately 2.4g of water are stored for every 1g of glycogen in the liver[8] and many experts agree that muscle glycogen will hold over 3g of water per gram of glycogen. Therefore, assessing glycogen levels and glucose metabolism is of the utmost importance.

PROCEDURE

1. MMT the small intestine related muscles - the abdominals and quadriceps

2. If weak, test the following, observing for strengthening:
    a. Oral nutrient test with water by itself
    b. If water does not strengthen, test with salt ("a pinch")
    c. If there is no change in the test with salt, keep the salt on the tongue and add water, asking the patient to mix the two in their mouth, effectively creating a saltwater solution
    d. If there is no change with the saltwater solution, test the muscle for strengthening with sucrose, glucose, or some other carbohydrate (do not use fructose)
    e. If there is no change with the sugar, next add water to the sugar on the tongue as performed earlier with the salt, mixing the two into a sugar-water solution

3. Treatment: Per the substance or solution which strengthened the weak small intestine muscle, advise the following dietary changes:
    a. If water, have the patient drink frequently throughout the day and investigate caffeine intake (too much = dehydration)
    b. If salt, advise the frequent use of sea salt on foods throughout the day, aiming for ½ to 1 tsp per day, (1,000-2,000mg)
    c. If saltwater, advise both 3a. and 3b.
    d. If sugar, investigate dysglycemia or low glycogen stores.
    e. If sugar-water, combine 3a. and 3d.

4. Sometimes hydration is thought to be a problem with the patient but the small intestine associated muscles remain strong and autogenic inhibition is normal (the muscles weaken with spindle cell activation). In this case, oral nutrient challenging the small intestine related muscles with either salt or caffeine may reveal a hidden weakness to those muscles. This would indicate too much of the [challenge] substance, resulting in subclinical dehydration. Rarely, this author has seen the same occur with a sugar test.

    A note regarding caffeine intake At the time of this writing, February 2009, the energy drink "Cocaine" is available in New Zealand and Australia, (US FDA has currently banned the drink). It

contains 280mg of caffeine per 8.4oz, which is the equivalent amount of caffeine found in 3 cups of espresso. Products like this and the ever familiar "Red Bull" (80mg caffeine) are what many teens and adults are drinking day in and day out, leading to various health problems as well as functional, and perhaps pathological, problems associated with dehydration.

CONCLUSION

Proper assessment of hydration, or the lack thereof, involves testing the small intestine related muscles against water, electrolytes (most often salt), and carbohydrate solutions. Some patients will only respond to specific ratios of the substrate to solution, while with others any solution will do provided it is not too concentrated (>8% solution). Assuming that a patient is well hydrated because they do not test for water and/or the psoas-kidney related muscles are functioning normally will often result in many missed dehydration cases. Dehydration is a major health concern, especially with the influx of popular sports drinks on the market containing high amounts of sugar and caffeine. Ultimately, one does not have to exert much effort to lose 2-3% body weight.

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