

# THIAMINE IS *THIAMINE*—RIGHT?

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According to *Dorland's Illustrated Medical Dictionary*, 27<sup>th</sup> Edition, there are at least three forms of thiamine; thiamine pyrophosphate (co-carboxylase) which is defined as the [metabolically] active form; thiamine hydrochloride used intramuscularly for treatment of thiamine deficiency; and thiamine mononitrate which is used in the preparation of multivitamin supplements.

The *Textbook of Medical Physiology*, Guyton, A., W.B. Saunders Co., Sixth Edition, states on page 908, paragraph 3 “Thiamine operates in the metabolic systems of the body principally as *thiamine pyrophosphate*; this compound functions as a cocarboxylase...”

*Human Biochemistry*, Orten, J., Neuhaus, O., Mosby, Tenth Edition states that “It occurs in nature either as the free vitamin or as the pyrophosphate”, p.769.

As the above cited references show, pyrophosphate is the active form of thiamine. What about the other forms, are they useless in the human system? All scientific references *suggest* that unless the other forms can be converted to the co-enzymatic pyrophosphate form they are useless.

## METHODS OF DETERMINING THIAMINE DEFICIENCY

One method for evaluation of thiamine status is the measurement of erythrocyte (red blood cell) transketolase activity. Red blood cells, which lack mitochondria, have no alternative means of generating NADPH (niacin metabolite) save the pentose phosphate pathway. Also, NADPH is required to reduce glutathione in order to maintain the normal structure of red blood cell and maintain hemoglobin in the ferrous state. Therefore, the pentose phosphate pathway is essential in red blood cells. Transketolase is a thiamine pyrophosphate-requiring enzyme, which catalyzes reactions in the pentose phosphate pathway. So the level of transketolase activity in the red blood cell is a reliable diagnostic indicator of thiamine status. This is not an inexpensive test.

Here is another method of determining thiamine need that is included in the Gateway Panel available through LabCorp. All of the laboratory books I have in my possession say that an increased Anion Gap is a marker of metabolic or lactic acidosis in an alcoholic (ah...might a non-alcoholic develop lactic acidosis?). CO<sub>2</sub> is a by-product of Krebs Cycle and when it is decreased in the serum we can conclude that this pathway is impaired. I have had good success in reducing Anion Gaps and raising CO<sub>2</sub> levels by recommending the patient restrict consumption of refined carbohydrates and refined sugars and supplementing them with a source of food grade thiamine such as **Bio 3B-G**. This product provides the pyrophosphate or active form of thiamine and other B complex fractions. I know of only one source of cocarboxylase in the world and gram for gram it is almost as expensive as cocaine. If you survey what is available in the marketplace today, you will find that BRC is one of the few food supplement manufactures/suppliers providing the co-enzymatic form of thiamine to their customers.

Symptom assessment is another method of determining thiamine need. Common symptoms relating to this are fatigue, depression, cyclic personality, soft tissue pain, low blood pressure, unwarranted fear of impending doom, hypoglycemia, nerve inflammation, carbohydrate sensitivity, vulnerability to insect bites, chronic need for HCl, loss of muscle tone, bradycardia and wet beri-beri. Patients using alcohol and refined foods may have a sub clinical need for thiamine.

Patients presenting a chronic need for thiamine or those who do not respond to therapy as expected should be evaluated for possible need for one or more thiamine co-factors. These are manganese, zinc, magnesium and unsaturated fatty acids. The patient who does not respond to the above therapy should be considered for a 24-hour urinalysis or hair analysis to rule out or establish a mercury body burden. If the patient is mercury toxic consider supplementing them with **PorphyraZyme** at 4 tablets t.i.d. on an empty stomach and **Methionine 200** at 1 capsule with each meal.

### **CALCULATING THE ANION GAP**

The correct method of calculating the gap is as follows:

$$\begin{array}{rcl} (\text{Sodium} + \text{Potassium}) & = & X \\ (\text{CO}_2 + \text{Chloride}) & = & Y \end{array}$$

$$X - Y = \text{Anion Gap} \quad (\text{Optimum range } 7 - 12 \text{ mmol/L})$$

The Gateway Panel available from LabCorp does not include calculation of the Anion Gap. It does include all the tests needed to calculate the Gap. When I designed the panel I did include this calculation for a reason; if you calculate it based on the above formula, you know it's correct. Many labs do not calculate the gap correctly; they leave the potassium value out of the formula. If you use a lab that provides the Anion Gap on their chem panel I suggest you calculate it at least once with the above formula to be sure it is correct.

### **WHAT ABOUT THIAMINE MONONITRATE?**

If you have been using BRC products for any length of time, you know that some of their products contain this form of thiamine. As stated above this form can be converted to the pyrophosphate form at the intracellular level. Food grade source and coal-tar sources of this vitamin are available; as you might expect BRC uses the food grade source. This can be converted to the co-enzymatic form and not overload the detoxification channels removing coal-tar metabolites and it is cost-effective for the patient.

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