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Sick of feeling sick?

The Organic Acids test may help you

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ORGANIC ACIDS TESTING

Determining Individual Biochemical Needs
To Take the Guesswork Out Of Supplementation Programs

This is an invaluable tool for your practitioner to truly get to the bottom of what is ailing you

Urinary organic acids: Are derived from the metabolic conversion of dietary proteins, fats, and carbohydrates, in addition to bacterial origin in the gut. These markers provide a unique profile into cellular energy status, neurotransmitter metabolism, nutrient deficiencies, and intestinal bacterial metabolism.

Urinary Metals: Increased urinary losses of essential trace elements occur under a variety of circumstances such as retention of heavy metals, exercise, hormonal status, skewed amino acid intake, injury, surgery, infection, excess alcohol, excess supplementation or underlying pathology.

Porphyrins: Urinary measurement allows us to confirm the breakdown of a toxin or heavy metal. This test gives an indicator of environmental exposure to heavy metals and organic compounds, includng polychlorinated biphenyls (PCBs). These substances are known to cause many neuro-developmental and behavioural disorders. This tests kit is for level 3 Detox and will test

Because we all have unique bio-chemical needs, some individuals may need more of a nutritional supplement than others. Some patients may have a deficiency in coenzyme Q10, for example, while others are in need of vitamin B12. In the past, there was no way to determine the specific supplement needs of each individual. However, with advances in medical technology, a test is now available that provides clinical insights essential to individualize personal supplementation protocols. Metabolic organic acid testing provides the biochemical basis to give supplement consumers guidance to their specific vitamin, mineral and amino acid needs relative to their health status, genetic tendencies, aging and oxidative status. A comprehensive analysis of the body's naturally occurring organic acids provides a road map leading to a final destination of optimal health.

Organic acid testing gives clinicians and patients alike an intriguing look at different metabolic pathways, enzyme and cofactor status and overall biochemical health efficiency, all of which determine the way the body uses nutrients. The versatility of this test empowers patients to individualize their supplement routines to maximize effectiveness and ensure that a critical missing link isn't overlooked.

First and foremost, organic acid tests are important for those seeking to fine tune or increase a supplement program's effectiveness. Once the report is returned, the patient receives specific recommendations of vitamins, minerals, nutrients and amino acids and dosage suggestions. Depending on overall health status and medications taken, either implementation or discussion with one's physician or nutritional supplement expert is recommended.

I have recommended hundreds of patients to access this high tech yet affordable testing tool. The clinical benefits seen when the body's unique needs are addressed can be the difference between modest clinical results versus a significant metamorphosis. Observation has shown that though human beings have more commonality than differences, identifying and treating the differences can establish a strong health and wellness foundation.

What are Organic Acids?

Organic acids, also called carboxylic acids, comprise key intermediary compounds of many biochemical pathways as well as exogenous compounds. Metabolic organic testing provides critical insights into the functioning of the tricarboxylic acid, TCA cycle (also called the Krebs cycle) in the mitochondria. The Krebs cycle is comprised of nine organic acids and eight enzymes and is the central metabolic pathway for all dietary fuel sources including carbohydrates, proteins, and fats. Deficiencies in any of the Krebs cycle enzymes cause an inefficient cycling of the organic acid intermediates; indeed a single deficiency can alter energy production and proper metabolism. Because the Krebs cycle provides the energy required for the body to function, any disruption in its flow can be disastrous to health.

More than Just a Genetic Issue.

Everyone has inherent strengths and weaknesses within their personal biochemistry that determines how much of a particular nutrient – or even if that particular nutrient – will be of benefit to their bodies. In some cases, weaknesses in personal biochemistry are genetic. Certain genetic "true disease" states called metabolic defects are commonly known as organic acidurias, referring to an imbalance of one or more organic acids. Metabolic organic acid testing can identify birth defects categorized as Inborn Errors of Metabolism (IEM), generally rare, and potentially fatal, abnormalities that occur in 1 in 5,000 live births.[1] However, the other 4,999 may not have an overt disease of their organic pathway, but still have strengths and weaknesses within their personal biochemistry. Therefore, instead of merely guessing whether a certain nutrient may be low relative to the body's nutritional requirements, it's now possible to also fine tune nutritional supplement programs via a simple test where patients collect urine samples in the convenience of their homes and send them to an internationally recognized and nationally certified laboratory. By taking this test, patients have a better understanding of their own unique health needs.

Organic Acid Imbalances

Abnormal organic acid metabolism can indicate that an individual is deficient in a number of nutrients or is simply not using those nutrients effectively. The key concept here is "defective enzyme activity," which exists in varying degrees of severity encompassing a spectrum of effects from mild to severe. Some of the reasons behind the defective enzyme activity are outlined in Table 1.

The use of nutraceutical dosing of specific vitamins and nutrients can help balance altered and imbalanced metabolic pathways. Some well known metabolic imbalances include carboxylase deficiency, megaloblastic anemia, methylmalonic aciduria, and B6-responsive anemia to name just a few that respond favorably to pharmacological doses of vitamins. Relatively high doses of the vitamin component of the corresponding coenzyme restores enzymatic activity, allowing the body to efficiently use whatever nutrient is malabsorbed or lacking.[2]

Classic Example of Organic Acid Imbalance

Methylmalonic acid (methylmalonate) has long been known as a vitamin B12 deficiency marker. As serum levels of cobalamin (B12) decrease, levels of urinary methylmalonate increase. The research of Miller et al. has recently shown that methylmalonate is a reliable index of defective enzyme activity, namely transcobalamin II (TCII), responsible for transporting B12 from the ileum portion of the small intestine to the tissues. This results in a decreased binding affinity of the enzyme for B12 with consequent compromised delivery of B12 to tissues, and overall decrease in B12 functional status.

Metabolites, Cofactors and Markers Measured

Organic acid profiling to determine individual supplementation needs typically encompasses a panel of approximately 40 compounds categorized into: Glycolysis and Krebs Cycle Metabolites, Fatty Acid Oxidation, Ketone Metabolites, Cofactor and Neurotransmitter Markers, and Detox-ification Markers. When an organic acid imbalance occurs, it can affect the way the body uses a particular nutrient. The following provides a glimpse of the clinical significance of identifying even one imbalanced organic acid.

Glycolysis Metabolites

Carbohydrate metabolism is particularly important to maintain health and ward off the risk of diabetes, obesity and premature aging. Pyruvate and lactate are direct metabolic markers of the efficiency and function of dietary carbohydrate ingestion.

- Pyruvate is the end product of glucose metabolism. Elevated levels can point to a B vitamin and lipoic acid deficiency. Elevated levels are clinically correlated with malnutrition and anorexia.

- Lactate serves as a Krebs cycle precursor. Increased lactate can signify decreased energy production, a CoQ10 deficiency and biotin, thiamine or lipoic acid deficits. Clinically elevated lactate occurs in chronic infectious disease, consumption of certain drugs, over consumption of alcohol, blood sugar dysregulation and genetic errors of metabolism.

Krebs Cycle Metabolites

Alpha-Ketoglutarate, Cis-Aconitate along with the following other Krebs cycle metabolites are all critical in creating cellular energy production. Many of these metabolites are not surprisingly also preferred mineral chelates such as citrate, malate, fumurate and succinate. The reason these metabolites are used is that the body preferentially seeks to absorb these key metabolic building blocks.

- Citrate – Increased citrate levels can suggest an amino acid deficiency or problems with protein metabolism.
- Isocitrate – Decreased levels suggest insufficient amino acid availability.
- Succinate – Low levels can indicate a need for branch chain amino acid augmentation particularly leucine and isoleucine.
- Fumarate – Increased values suggest CoQ10 deficiency. Or, when citrate, malate and alphaketo-glutarate are also increased, then a cytochrome C deficiency may be present. Cytochrome c is an iron-containing protein found in the mitochondrial inner membrane. It is a soluble protein and is an essential component of the electron transfer chain. It is capable of undergoing oxidation and reduction and is essential for the transfer of electrons and energy transmission.
- Malate – High levels indicate a higher need for nutrients such as niacin and CoQ10. When elevated in the presence of high citrate, fumurate and alpha-ketogluturate levels, this strongly suggests cytochrome C oxidase deficiency, indicating that energy pathways in the body are disturbed.

Fatty Acid Oxidation

The importance of essential fatty acids, short and long chain fatty acids and the metabolism of each pathway is equally as important as ensuring proper supplementation of life-sustaining omega-3 and omega-6 essential fatty acids.

- Adipate – When elevated, clinical symptoms can include weakness, nausea, hypoglycemia, feet odor, and recurrent infection.
- Suberate – Increased in carnitine deficiency states and the inability to properly fuel mitochondria. Can also point to insufficient riboflavin (B2) levels.

- Ethylmalonate – This fatty acid metabolite when elevated indicates carnitine and riboflavin deficiency states. This can lead to the inability to oxidize long-chain fatty acids and amino acids. When elevated in the presence of high levels of adipate, a severe fatty acid oxidation impairment is potentially present.

- Methylsuccinate – High levels can point to ketosis, hypoglycemia, lactic acidosis, liver dysfunction, malnutrition, impaired beta-oxidation, weakness, nausea and fatigue.

Ketone Metabolites

Alpha-Hydroxybutyrate and Beta-Hydroxybutyrate are significant signs reflecting carbohydrate metabolism. This is illustrated during elevated levels of Betahydroxybutyrate seen in poor carbohydrate processing and elevated glutathione production arising from potential toxicity exposure, intestinal bacterial imbalances, certain drug interactions and disease states demanding higher glutathione levels to combat cellular damage.

Markers of Cofactor Need

Alpha-Ketoisovalerate, Alpha Ket-oiscaproate, Alpha-Keto-Beta-Methyl-valerate, Beta Hydroxyisovalerate, Methyl- malonate, Kynurenate and Hydroxy- methylglutarate are all critical markers for specific nutritional supplementation. Hydroxymethylglutarate, for instance, when low indicates a low Coenzyme Q10 intake or a decreased synthesis as a result of altered HMG-CoA reductase activity. An individual taking a “statin” drug with low levels of this cofactor marker should certainly be made aware of potentially higher risk of side effects.

Markers of Neurotransmitter Metabolism

Dreams, aspirations, emotions, thinking and bodily control are all dependent upon adequate levels of neurotransmitters built from amino acids and co-nutrients essential to sustain sufficient brain chemistry. Quinolinate, Vanilmandelate and the following two markers are clinically vital for peak cognitive and emotional performance.

- Homovanillate – Low levels correlate with low central nervous system levels of epinephrine and norepinephrine associated with signs of depression, insomnia, fatigue and inability to cope with stress.

- 5-Hydroxyindoleacetate – This serotonin metabolite when altered can point to a higher need for tryptophan. Clinical signs of low serotonin can include depression, fatigue, insomnia, ADD and other behavior imbalances.

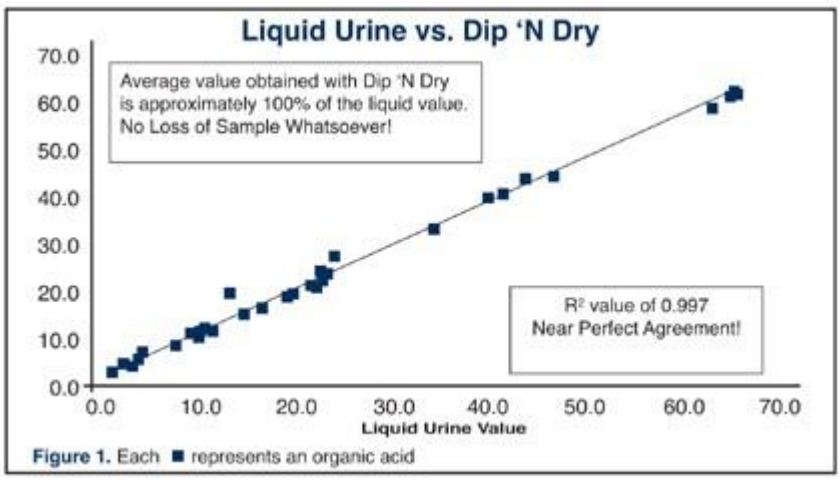

Figure 1. Each ■ represents an organic acid

Markers for Detoxification

Benzoate, Pyroglutamate, Orotate along with the following detoxification markers provide insights into the capacity and success of the body to process and cope with an increasingly toxic environment.

- Para-Hydroxyphenylacetate – Increased levels can indicate an overgrowth of gastrointestinal bacteria or protozoa such as Giardia, C. Difficile, Proteus vulgaris or other intestinal infections.
- Hippurate – When hippurate is low and benzoate is elevated this suggests that there is poor conjugation with glycine and can reflect the presence of an impaired Phase II liver detoxification pathway.

Bacterial By-Products

Para-Hydroxybenzoate, 2-Hydroxy-phenylacetate, 3-Indoacetate, Tricarballylate and Para-Hydroxyphenylacetate are affected by the overgrowth of gastrointestinal bacteria or protozoa such as Giardia, C. Difficile, Proteus vulgaris or other intestinal infections. Additional balance of friendly flora and overall gastrointestinal ecology is reflected by total balance of these bacterial by-products.

How is the Test Performed at the Lab?

Gas Chromatography/Mass Spectrometry (GC/MS) has been the gold standard for organic acid analysis over the last three decades. Its primary asset is that it allows for accurate and precise quantification of a myriad of compounds simultaneously. It has contributed greatly to understanding many disease states.

For example, organic acid analysis via GC/MS has helped to identify diabetes mellitus as not only a defect in glucose metabolism but also of amino acid and fatty acid metabolism.[4]

Two proposed ways to test for organic acids are either by the proven, tried and true GC/MS method 4-18 or with an alternative and less proven method that many labs have opted for called the LC/MS/MS.19-24 Though for limited sampling of a few organic acids LC/MS can offer some utility when analyzing 40 plus organic acids, the simplicity of LC/MS and cost-effective-ness for the lab is offset with potential variability of results unacceptable when patient health is involved.

The overriding advantage as reported in Clinical Chemistry in LC/MS/MS methodology is through high volume lab efficiency analysis, as opposed to the quality of the results obtained in the analysis.[25] The results from GC/MS, on the other hand, are known to be of high quality, but the number of samples run per instrument is relatively low, as the run times are usually much longer. In fact the GC/MS is renowned for its capacity to identify the most important metabolic compounds with greater accuracy and precision than other similar technologies.[4-18]

Just as a car is tested for emission, the human body's fluid output can provide significant data. A simple urine sample analyzed by GC/MS can easily provide the results of 40 of the most important major organic acids. With technological advances, an easy to use Dip N' Dry urine collection strip can be soaked with urine, allowed to dry for an hour and then shipped for analysis via regular mail. Patients report amazement at the ease of the process, convenience and comfort of home collection and being pleased with an approximate average turn around time of 10-14 days.

A Test of Organic Acid Stability

Initial investigations into the nature of organic acids showed insufficient stability of liquid urine samples. A simple urine collection strip (Dip 'N Dry) was developed by our laboratory along with a special kit to dry the sample quickly during transport from distant overseas and interstate locations where delivery of the specimen to the lab can be delayed significantly. Upon arrival at the lab, the sample is rehydrated and quickly analyzed.

The sample's rehydration process is extremely accurate when using the Dip 'N Dry collection strip. Compared to results from a fresh liquid urine sample, the results are precise (see Figure 1). Unlike a liquid sample sent to the lab, where there is extreme instability, these collection strips offer major stability. In fact, the absorbent materials used in the strips are specifically designed and have been used for years in investigating Inborn Errors of Metabolism organic acid imbalances.[12,14,17,19]

Conclusion

Dysfunction in any particular enzyme protein complex that involves the absorption, transport, activation, and/or utilization of a vitamin can result in an elevated urinary organic acid indistinguishable from one caused by dietary deficiency. With this in mind, measuring organic acids in urine can serve as a marker for depletion of nutrients at the cellular level, whether from a nutrient deficiency or a defective enzyme, making organic acid analysis the ultimate test of cellular need for a personally tailored nutritional approach. Investigating individual nutritional needs with the simplicity of metabolic organic acid testing is a must for those seeking longevity and improved health.

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