

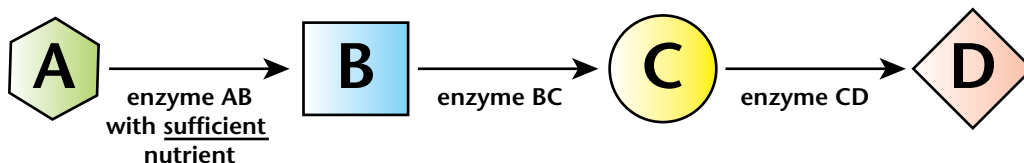


## The ABCs of Organic Acids

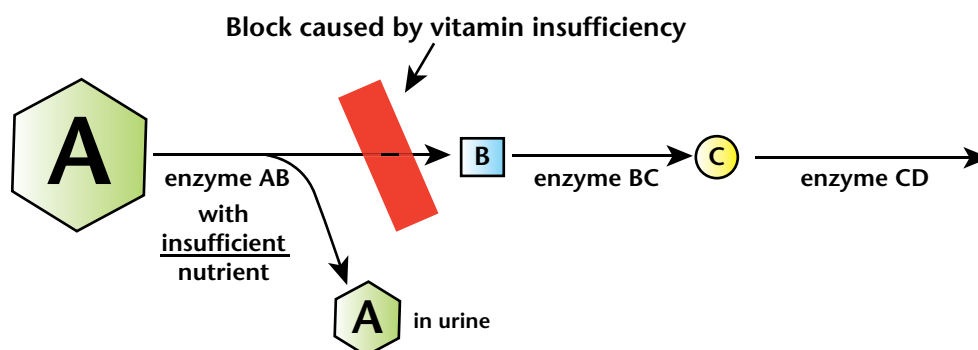
Your Organix™ Basic Profile is like an emission test performed on your car. The exhaust is examined to see how efficiently the engine is burning fuel. Similarly, certain compounds called “organic acids” in your urine reveal the efficiency of your body’s machinery.

Many organic acids result from the metabolic pathways, or chemical reactions, your body uses to transform food into energy, growth, maintenance, and repair of body tissue. Like spark plugs that ignite fuel in a car engine, vitamins and other essential nutrients are necessary for these chemical reactions that power your metabolic machinery. Thousands of these reactions occur in your body every second and are the basis of your level of health and vitality.

The figure below illustrates a well-functioning metabolic pathway. Molecule A is converted to Molecule B by the enzyme AB. Molecule B is converted to Molecule C by the enzyme BC and so on all the way down the metabolic pathway. Many enzymes require nutrients such as specific vitamins and minerals in order to perform their functions in converting one molecule to another.



If specific nutrients are not available in adequate amounts, important reactions cannot occur as well as they should. The illustration below shows what happens when the nutrient is not present in adequate amounts so that enzyme AB functions inefficiently. A small amount of Molecule A is converted to Molecule B and the remainder builds up and spills into the urine. Notice that Molecules B through D downstream are also affected.



Visualize this process as a dam blocking a stream — very little water flowing downstream and an overflow occurring upstream. The Organix Basic Profile measures the overflow of certain organic acids in your urine to determine what blockages may be occurring in your metabolic pathways due to nutrient insufficiencies or other issues.

High levels of many organic acids on your report can indicate which nutrient insufficiencies may be affecting your health. Other organic acids come from toxins you have been exposed to, and still others show how your body is responding to toxins. When these are high on your Organix Basic Profile, you may benefit from therapies that support your body's detoxification processes. A few organic acids are significant at low levels; these are discussed below.

Your healthcare practitioner can use this profile to design an individual nutritional support program tuned to your unique biochemical needs.

The following is a discussion of the compounds measured in four categories on your Organix Basic Profile. The organic acids are numbered as they appear on your test report.

### ***B-Vitamin Sufficiency***

Insufficiency of B vitamins tends to be common since they are not stored as efficiently as other vitamins in the body. B vitamins are involved in many critical processes including energy production, digestion, and muscle and nerve function. For example, production of stomach acid requires large amounts of energy. Even modest B-vitamin insufficiencies can compromise adequate energy production, leading to poor acid secretion and digestive disturbances commonly experienced as indigestion.

**1. Pyruvate** may be elevated when B vitamins, particularly B<sub>1</sub> and B<sub>5</sub>, are insufficient. When both lactate (#13 below) and pyruvate are high, there may be insufficient lipoic acid, a type of B vitamin. Lipoic acid is an important antioxidant, so low levels can lead to aging-related illnesses. Many studies have shown that lipoic acid is helpful in treating diabetes and for assisting the liver with removing toxins from the body.

**2, 3, 4, 5.  $\alpha$ -Ketoglutarate,  $\alpha$ -Ketoisovalerate,  $\alpha$ -Ketoisocaproate, and  $\alpha$ -Keto- $\beta$ -methylvalerate** require vitamins B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>5</sub> and lipoic acid to be metabolized. Elevations of these organic acids indicate insufficiency of these B vitamins, especially B<sub>1</sub> and B<sub>5</sub>. These B vitamins are involved in neurological function and are critical for childhood development and learning. A variety of disorders have been associated with a lack of these vitamins, including memory loss, anemia, and dermatitis.

**6. Xanthurenate** is formed from an amino acid that comes from protein in your diet. High levels can indicate an insufficiency of B<sub>6</sub>, a vitamin critical for all protein metabolism. Use of medications such as oral contraceptives, anti-hypertensives, and bronchodilators and exposure to tobacco smoke as well as pesticides and other agricultural products can all contribute to insufficiency of vitamin B<sub>6</sub>. Problems with balance, fatigue, and mental/emotional stability (such as PMS and ADHD) are frequently found in patients with inadequate vitamin B<sub>6</sub>. Research has shown that symptoms of autism can be ameliorated with vitamin B<sub>6</sub> supplementation. Additionally, xanthurenate can prevent insulin from performing its vital role in blood sugar regulation, which can contribute to diabetes.

**7.  $\beta$ -Hydroxyisovalerate** is a sensitive indicator of biotin deficiency. Biotin deficiencies develop for a number of reasons, including pregnancy, antibiotic use, and anticonvulsant therapy. Symptoms can include hair loss, skin rash, dermatitis, immune deficiencies, and muscle weakness.

**8. Methylmalonate** requires vitamin B<sub>12</sub> for its metabolism. High levels indicate insufficient vitamin B<sub>12</sub> that can contribute to nervous system dysfunction. Anemia and the associated symptoms of fatigue result from low vitamin B<sub>12</sub>. Even mild insufficiencies cause elevation of a well-known cardiovascular disease risk factor, homocysteine. Absorption of vitamin B<sub>12</sub> requires normal digestive function.

**9. Formiminoglutamate (FIGLU)** is a sensitive marker of insufficiency of folic acid, another B vitamin. Pregnant women especially need to have adequate folic acid to prevent birth defects. Folic acid insufficiency can play a role in childhood development problems, depression, immune function, and is a risk factor for cardiovascular disease.

## Cellular Energy

Although B vitamins also impact energy production, this category measures compounds that relate most directly to how efficiently your cellular engines (called “mitochondria”) produce energy. All body processes depend on this key activity. Inadequate energy production at the cellular level can affect any aspect of your body’s function and can have dramatic impact on a wide range of health conditions.

**10, 11, 12. Adipate, Suberate, and Ethylmalonate** elevations indicate metabolic blocks. Carnitine is needed to move fatty acids into the mitochondria where they are converted to energy using vitamin B<sub>2</sub>. When insufficient levels of carnitine or vitamin B<sub>2</sub> slow down this process, other parts of the cellular machinery take over and make adipate and suberate. A similar block in another pathway causes high ethylmalonate. Since most of your body’s energy is produced from the burning of fatty acids, your muscles and brain suffer when this cellular energy pathway is blocked. Supplementation of carnitine and vitamin B<sub>2</sub> may be needed when these compounds are too high. Insufficiency of vitamin B<sub>2</sub> is implicated in impaired carbohydrate metabolism, migraines, and dementia. Carnitine supplementation has been documented to improve Alzheimer’s, age-related cognitive decline, and cardiac function.

**13. Lactate** is a product of muscle use, so it is constantly produced in normal daily activity. Low lactate is seen in people with very little physical activity and in highly trained athletes. High lactate can cause muscle cramping, fatigue and brain fog. It indicates insufficiency of coenzyme Q10 (CoQ10), a nutrient that enables the body to use oxygen to generate large amounts of energy. It is important for athletes in order to maintain intense muscular activity. CoQ10 is also a potent antioxidant helping to slow the aging process and prevent a variety of degenerative diseases. Risk for certain kinds of heart disease, cancer, and hypertension are increased when CoQ10 is insufficient.

**14. β-Hydroxybutyrate** is a byproduct of ketosis. Ketosis occurs when cells do not get a steady supply of sugar from dietary carbohydrate, so they burn fat instead. If you do not eat carbohydrate-rich foods or if your insulin is not working, then you can have metabolic ketosis. It is not necessarily a serious matter, but your doctor may need to find out just what the cause is. If your insulin is not working well enough, its action may be improved by increasing your intake of chromium, vanadium, and lipoic acid.

**15, 16, 17. Succinate, Fumarate, and Malate** are used in the body’s metabolic pathway that generates cellular energy – the Citric Acid Cycle. This cycle critically supports organ maintenance and neurological function. Higher levels of these compounds in urine indicate inefficiencies in energy production. Low levels can indicate a general amino acid insufficiency. If α-ketoglutarate (see #2) is elevated along with succinate, malate, and fumarate, you may need additional CoQ10, a nutrient that enables the body to use oxygen to generate large amounts of energy.

**18. Hydroxymethylglutarate (HMG)** is used by your cells to make CoQ10, a nutrient that enables the body to use oxygen to generate large amounts of energy. Cholesterol-lowering statin drugs block this process, causing HMG to become elevated and inhibiting the production by the cells of CoQ10. While there can be other causes for this metabolic block, high levels of HMG generally indicate need for CoQ10 supplementation.

## **Neural Function**

This category relates to neurotransmitters, the chemicals your nervous system uses to function and communicate with your body. The first three compounds in this category are significant if they are either low or high. Abnormalities in this area can relate to symptoms of mental, emotional, and behavioral problems.

**19, 20. Vanilmandelate (VMA) & Homovanillate (HVA)** are breakdown products from neurotransmitters involved in hormone and nerve impulse transmission. When these compounds are low, it indicates your body is not making enough of these neurotransmitters. Symptoms associated with this condition are depression, sleep disturbances, inability to deal with stress, and fatigue. Treatments to improve digestion, along with supplementation of tyrosine or phenylalanine, can help improve the ability to keep up with demand for these neurotransmitters. Elevations of VMA and HVA indicate an over-activation of nervous system function involving these neurotransmitters. This can be for various reasons, but is most commonly associated with stress – both internal (e.g., mental/emotional) and external (e.g. environmental toxins). Addressing the source of stress and improving the body's ability to handle stress are useful in these cases.

**21. 5-Hydroxyindolacetate (5-HIA)** is a breakdown product of the neurotransmitter, serotonin. Low 5-HIA indicates inadequate production of serotonin. Associated symptoms can include constipation, depression, fatigue, insomnia, and attention deficit and behavioral disorders. High 5-HIA may occur when there is an increased utilization and breakdown of serotonin. Many antidepressant medications can cause a significant increase in the amount of serotonin that is made and broken down. This stimulation will contribute to loss of the essential amino acid, L-tryptophan, from which serotonin is made. Dietary therapy should focus on protein digestion via stomach acid and pancreatic enzymes, and on consumption of foods high in tryptophan. Your doctor may talk with you about nutritional supplements that may be helpful.

**22. Kynurenate** can reduce the toxic effects of quinolinate (see #23). Elevations can indicate an insufficiency of vitamin B<sub>6</sub>, especially when xanthurenate (see #6) is high.

**23. Quinolinate** elevations are caused by inflammatory processes induced by the immune system, such as during infection (especially viral). High quinolinate levels in the brain can cause insomnia, irritability, and nervousness. These effects may be improved by removing the source of inflammation and supplementation with magnesium.

## Detoxification Function

Not only does the body use essential nutrients to actively build and maintain itself, it also must eliminate environmental toxins and certain chemicals created in the body itself. This process of detoxification is critical to health. Like a backed-up sewer, an impaired detoxification system can lead to many problems. Brain fog, headaches, insomnia, nausea, chemical sensitivities, and a variety of chronic health problems have been related to toxicity issues.

**24, 25, 26. Citrate, cis-Aconitate, and Isocitrate** are involved in both energy production and removal of toxic ammonia. High levels can indicate ammonia toxicity. Chronic loss of these valuable compounds can contribute to loss of organ reserve and disturbances in neurological function. If they are low they can indicate a need for essential amino acids, especially arginine.

**27. 2-Methylhippurate** is a byproduct of detoxification of the common solvent, xylene. Elevations indicate an exposure to this potentially toxic compound found in paint, varnishes, paint thinners, solvents, and many aerosols. Such exposures increase the burden on liver detoxification. An abundant supply of the amino acid, glycine, and vitamin B<sub>5</sub> are important for removing xylene from the body.

**28. Orotate** is a sensitive marker of your liver's capacity to convert toxic ammonia to non-toxic urea that you can excrete. That capacity can be increased by additional arginine. Ammonia toxicity can also be reduced by supplementation with  $\alpha$ -ketoglutarate, magnesium, aspartic acid, and glutamic acid. Ammonia impairs brain function, causing difficulty with thinking, fatigue, headaches, and increased food sensitivities.

**29. Glucarate** is formed as your liver performs its important role in removing from your body many types of toxins such as pesticides, prescription drugs, food components, and intestinal bacteria. Enzymes create glucarate when they are stimulated to increase liver detoxification. High levels of glucarate indicate your liver is working to remove these toxins. Removing the source of exposure and supporting the liver's detoxification with nutrients such as glycine, glutathione, n-acetylcysteine, and liver-specific antioxidants are helpful.

**30.  $\alpha$ -Hydroxybutyrate** is elevated when your body attempts to respond to metabolic stress by making additional glutathione. Because glutathione is critical for removing toxins and acts as a powerful antioxidant, your body is constantly making it in large amounts. Many disease processes can be adversely influenced by insufficiency of this vital nutrient. Elevated  $\alpha$ -hydroxybutyrate indicates high cell demand for glutathione. Supplementation with various sulfur amino acids and glutathione can be used to support adequate levels of this compound.

**31. Pyroglutamate** elevation indicates the body is using up glutathione to keep from losing amino acids. Glutathione is important for protection of cells from oxidation. Various amino acids, especially methionine and glycine, can help rebuild total body glutathione. Pyroglutamate elevation can also indicate a glycine insufficiency; supplementation with this amino acid may be indicated.