

## ORGANIC ACID TESTS - PROVIDER INFORMATION SHEET

In our continued effort to innovate and improve, we've now added six organic acid tests (OATs) to our DUTCH Complete™ and DUTCH Plus® panels.

Two neurotransmitter metabolites will offer insights into symptoms such as mood disorders and fatigue, and will be combined with markers for vitamin B12, vitamin B6 and glutathione deficiency.

These new markers make DUTCH testing the most comprehensive overview of patient health available in one test.



### NEUROTRANSMITTER METABOLITES

*These organic acids are the primary metabolite of dopamine, norepinephrine and serotonin. Patients with an imbalance in these neurotransmitters may experience symptoms that are also common with an imbalance in hormones. Hormones (cortisol and estrogen are examples) included in DUTCH testing also directly alter some of these metabolites, so their inclusion provides an even more comprehensive picture of your patient's hormone health.*

### HOMOVANILLATE (HVA) | PRIMARY METABOLITE OF DOPAMINE

If dopamine in circulation is low, HVA is usually low. People with low dopamine often report fatigue, low motivation, depression and addiction issues. These symptoms are similar to those with low hormones. Conversely, if there are low levels of SAM, Magnesium, FAD and NAD, dopamine cannot be converted to HVA. In these cases, HVA may be low even though circulating dopamine levels may be normal or elevated.

### VANILMANDELATE (VMA) | PRIMARY METABOLITE OF NOREPINEPHRINE/EPINEPHRINE

Cortisol, DHEA and norepinephrine/epinephrine are all released from the adrenal gland at different layers. A marker of the "other" major adrenal hormone gives providers more insight into adrenal and HPA axis function. If norepinephrine/epinephrine in circulation are low, VMA will usually be low. Epinephrine production (from norepinephrine) is actually a cortisol-dependent reaction and measuring VMA along with adrenal hormones enhances DUTCH adrenal testing even more.

### NUTRITIONAL ORGANIC ACIDS

These organic acids act as functional markers of nutrient deficiency. When the body has inadequate cellular levels of vitamin B12, vitamin B6 or glutathione, levels of their corresponding organic acid build up and spill into the urine. In some cases, these markers are more effective than measuring the nutrient directly. **See next page.**



## ORGANIC ACID TESTS

### **KYNURENATE** - marker for **VITAMIN B6**

**OTHER NAMES** | Kynurenic Acid or KYNA **RESULTS** | High Kynurenate = Low Vitamin B6

#### **SYMPTOMS OF VITAMIN B6 DEFICIENCY**

Fatigue, shortness of breath, irritability, anxiety and depression, low energy and fatigue

#### **TREATMENT OPTIONS**

Food high in B6 include turkey breast, grass-fed beef, pinto beans, avocado, pistachios, chicken, sesame and sunflower seeds. Supplementation may be advised.

#### **ADDITIONAL INFORMATION**

KYNA is a product of the metabolism of Tryptophan if there is a deficiency of Vitamin B6 BUT, chronic stress, reactive oxygen species (ROS) and possibility LPS from gram negative gut bacteria/leaky gut causing inflammation can increase KYNA as well. KYNA is useful in the body – anti-inflammatory, neuroprotective, some anti-ulcerative properties and antagonizes hypermobility of the intestines.

### **METHYLMALONATE** - marker for **VITAMIN B12**

**OTHER NAMES** | Methylmalonic Acid or MMA **RESULTS** | High MMA = Low Vitamin B12

#### **SYMPTOMS OF VITAMIN B12 DEFICIENCY**

Fatigue, brain fog, memory problems, muscle weakness, unsteady gait, numbness, tingling, depression, migraines/ headaches and low blood pressure.

#### **TREATMENT OPTIONS**

Common foods high in B12 include beef liver, sardines, lamb, wild salmon, grass-fed beef, nutritional yeast and eggs. Supplementation may be advised.

#### **ADDITIONAL INFORMATION**

This marker is considered superior to measuring serum B12 levels directly. A 2012 publication by Miller showed that 20% of those tested had a genetic defect in the protein that transports B12 to cells. These patients may have a functional B12 deficiency, even if serum levels of B12 are normal.

### **XANTHURENATE** - marker for **VITAMIN B6**

**OTHER NAMES** | Xanthurenic Acid **RESULTS** | High Xanthurenate = Low Vitamin B6

#### **SYMPTOMS OF VITAMIN B6 DEFICIENCY**

Changes in mood, such as irritability, anxiety and depression, confusion, muscle pains, low energy, or fatigue.

#### **TREATMENT OPTIONS**

Food high in B6 include turkey breast, grass-fed beef, pinto beans, avocado, pistachios, chicken, sesame and sunflower seeds. Supplementation may be advised.

#### **ADDITIONAL INFORMATION**

If levels of estrogen or cortisol are high, it may exacerbate xanthurenate elevations and increase the need for B6. Xanthurenate complexes with insulin and decreases insulin sensitivity. Xanthurenate can also bind to iron and create a complex that increases DNA oxidative damage resulting in higher 8-OHdG levels. If both markers are elevated, there is likely an antioxidant insufficiency.

### **PYROGLUTAMATE** - marker for **GLUTATHIONE**

**OTHER NAMES** | Pyroglutamic Acid **RESULTS** | When levels of pyroglutamate are high or low, there may be insufficient glutathione.

#### **SYMPTOMS OF GLUTATHIONE DEFICIENCY**

Glutathione is one of the most potent antioxidants in the human body. It is especially important in getting rid of toxins and can protect against cancer, aging, heart problems and brain diseases.

#### **TREATMENT OPTIONS**

High-quality lean protein, fresh fruits and vegetables, spices, increase alpha-lipoic acid, increase selenium, or add a multivitamin with glutathione-supporting vitamins.

