

## KEY TAKEAWAYS

### Quinolinate

Quinolinate is a neurotoxin derived from tryptophan. Quinolinate is a marker for potential neuroinflammation. Elevated quinolinate is found in neuroinflammatory disorders such as: Alzheimer's disease, Parkinson's disease, Huntington's disease, motor neuron diseases, multiple sclerosis, epilepsy, amyotrophic lateral sclerosis, and major depressive disorder. Low serotonin and vitamin B3 (niacin) deficiency can also cause elevated quinolinate.

### $\beta$ -Hydroxyisovalerate

Elevated  $\beta$ -hydroxyisovalerate are found as a result of biotin insufficiency. This issue often presents in patients as skin problems as well as hair loss. Providers should look for this DUTCH Test marker to assess their patients' biotin status and determine if intervention is required. Adequate biotin supply will yield a lower level of  $\beta$ -hydroxyisovalerate.

### Indican

Urinary indican is a test that can provide information on bacterial overgrowth in the gut. Indican is a biproduct of protein putrefaction. Specifically, indican is a metabolite of tryptophan metabolism in the gut. The increased presence of urinary indican indicates an increase in tryptophan putrefaction—usually as the result of gastrointestinal dysbiosis or malabsorption. Urinary indican can alert providers to concerns over gut health. While it is not a diagnostic indicator, indican can serve as a good starting point to determine if further investigation into gut health is necessary.

## Clinical Analysis of Quinolinate

### Causes of High Quinolinate Levels

- Inflammation
- Infection
- Alzheimer's disease
- Parkinson's disease
- MDD
- Phthalate Exposure
- Low serotonin
- Vitamin B3 insufficiency
- Inflammatory bowel conditions

### Interpreting Quinolinate Results

Elevated quinolinate levels alert providers to neuroinflammation, oxidative stress, infection, phthalate exposure, and low serotonin in their patients. Low levels of quinolinate may be observed but are usually the result of low tryptophan or low protein intake.

## Clinical Analysis of $\beta$ -Hydroxyisovalerate

### Causes of High $\beta$ -Hydroxyisovalerate Levels

- Inadequate dietary intake
- Long-term, high-dose vitamin B5 intake
- Lipoic acid supplementation
- Antibiotic use
- Medications (anticonvulsants)
- Biotinidase deficiency

### Interpreting $\beta$ -Hydroxyisovalerate Results

Providers can use  $\beta$ -hydroxyisovalerate results to identify a biotin deficiency in their patients. Low or, “normal,” levels of  $\beta$ -hydroxyisovalerate suggest a sufficient supply of biotin and should not be cause for concern.

$\beta$ -Hydroxyisovalerate accumulates in the urine when biotin is unavailable—so significantly elevated levels of this marker should be investigated.

Symptoms of biotin deficiency are broad and similar to the symptoms of other B vitamin deficiencies. They include scalp hair loss, total body hair loss, perioral dermatitis, and brittle nails. Other presentations of biotin deficiency are glossitis, conjunctivitis, neurological issues, and recurrent infections.

## Clinical Analysis of Indican

### Causes of Low Indican Levels

- Low-protein diet
- Vegetarian/vegan diet
- Unabsorbed antibiotics

### Causes of High Indican Levels

- Excess protein consumption
- Small intestine bacterial overgrowth (SIBO)
- Overgrowth of anaerobic bacteria in colon
- Malabsorption
- Constipation
- Intestinal disorders (Celiac disease, pancreatic insufficiency)

### Interpreting Indican Results

The presence of indican in higher concentrations suggests a degree of gut dysfunction. A healthy gut is necessary for optimal hormone health, and an unhealthy gut (dysbiosis, SIBO, etc.) can influence systemic hormone levels. Elevated urinary indican may imply gut dysfunction, which may lead to either elevated or lowered hormone levels and hormone-related symptoms.