The LabAssist™ Report Made Simple

Contents:

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What Does the LabAssist™ Report Provide?

- Information to balance chemistry.
- The concept of *Biochemical Individuality*.
- The awareness of subtle and not so subtle abnormalities in the patient's chemistry.
- The ability to monitor the patient's health status as well as treatment protocols.
- Practitioner efficiency through enhanced knowledge and simplicity yielding a smarter practice.
- A consistent look for the interpretation of all reports regardless of which lab it comes from.

The Comprehensive Blood Chemistry LabAssist™ Report How to read it. What do the test results mean?

Components:

a) Basic Status Report – Total Status Deviation, Total Status Skew
b) Client Summary Review
c) Practitioner Summary Review
d) Panel/Subset Report – Panel Status Deviation, Panel Status Skew
e) Drug Interactions
f) Nutrition Recommendations
g) Comparison of Previous Tests (if applicable)
h) Clinical Correlations

I. Basic Status Report

- Reviews of the *High* and *Low* test results ordered by the degree of their deviation from the mean.
- An inspection of the overall profile of the client's chemistry. It makes no decisions; its main use is to provide a first level map of the client's general health status.
- A graphical representation of all results listed in alphabetical order. Graphs are easy-to-read. Red areas indicate out-of-balance results.
- A quick review of the overall status of results. The higher the Total Status Deviation the worse the overall chemistry.
- An easy way to ascertain whether the patient's chemistry is in a deficient state (negative skew) or in a state of excess (positive skew).
- By presenting the results in this format, the report tries to make the reading of the results easier for both the practitioner and the patient.

Divided into 2 sections:

1st section– **Basic Status High/Low** - A quick review of the High and Low test results (using bar graphs) in order of their deviation from the mean.

2nd section – **Basic Status Alphabetic** - A graphical representation of all the results of the blood test listed in alphabetical order.

Components:

1. ***% Status*** - represents a conversion of the test result that allows us to process the results in a consistent and comparative manner. It is a *weighted deviation from the mean*. The % Status is a mathematical calculation that **represents the distance from the midpoint in relation to the range.** The range always equals 100%, so a value of 50% to either side is always at the edge of the range.

Ex: Albumin: If the result is 4.4 and the normal range is from 3.4 to 4.8, the mean, or mid-point is 4.1 and the spread is 1.4. In this case, at 4.4, albumin is 21.43% *above* the mean.

2. ***Total Status Deviation*** - represents the average percent status deviations (disregarding the direction + or -)

Note: The higher the *Total Status Deviation* the worse the overall chemistry.

Optimal TSD for CBC is to be below 20%.

50% = Red Flag

Over 75% = Severe Imbalances

3. ***Total Status Skew*** - represents the direction the overall individual leans towards.

This tool is a strong indicator of the client's overall health status.

If skew is negative = it means the average of all percent status deviations is negative.

If skew is positive = it means the average of all percent status deviations is positive.

Optimal TSS is between –5 and +5.

II. Client Summary Review

4 Components:

A. Nutritional Support – summary of nutritional recommendations

B. Nutritional Supplements to Avoid - list of nutritional supplements which may aggravate already out-of-balance biochemistry

C. Food Recommendations – list of foods that my help to balance or strengthen the client's biochemistry

D. Foods to Avoid – list of foods which may aggravate already out-of-balance biochemistry

III. Practitioner Summary Review

- Quick "Cheat Sheet" for the practitioner
- Reviews the most important data in the report**.**

  Components:

  A. Out-of-Balance Panel Values – List of panels which have a PSD (average imbalance of that subset results) of greater than 25%, indicating need for further review. Here the PSS is also listed in order to show the direction of that subset of results

  Remember: *negative = deficiency, positive = excess*

  B. Lab Reported Out-of-Range Values

  C. Additional Tests – Lists any additional lab tests which may help in diagnosis.

IV. The Panel/Subset Report

A breakdown of all the pertinent test results into their clinical "panel" to help the practitioner review different subsets and ascertain which of the client's bodily functions may be abnormal or imbalanced.

(There are 21 panels for the Comprehensive Blood Chemistry test as of this writing. Other tests have differing number of panels reported.)

- This section allows the practitioner to ascertain what laboratory diagnosis-related groups are abnormal quickly and easily.
- It allows the practitioner the ability to see which panel is most deviated and may need the most immediate attention.
- The *Panel Status Skew* (see definition below) gives meaning to the abnormality and helps suggest a potential course of action in the treatment protocol.
- You can more easily monitor specific areas of a client's health status especially when they are undergoing a treatment protocol.

Uses of Panel/Subset Section:

- This section helps the practitioner monitor specific areas of a client's health status, especially when they are undergoing a treatment protocol. You can compare results from one test to another and see if there are any problems with the treatment protocol.

- It allows the practitioner to practice efficiently and informs the client as to their health status in a more specific and informed manner. Any time the client is more involved and educated in their health status, compliance with the practitioner's guidelines goes up. This in turn helps improve the client's general health status.

Panels are easy to read:

- Uses familiar bell curve
- Closer to the mean the better
- Green = normal results. This means the average (PSD) of the variables within the panel grouping is between –24.99% and +24.99%.
- Red = between 25-49.99% + or –
- Brown = between 50-74.99% + or –
- Black = 75% + or – or above
- Each has a text definition

Panels are functional test groups based on organs or metabolic processes (e.g. liver, kidney, lipids, nitrogen, etc.).

Using the concept of the % Status, we can quantify the abnormalities of the different panels and rank them by using the **Panel Status Deviation** and the **Panel Status Skew** (similar to TSD and TSS, just smaller subsets).

Components:

1. **Panel Status Deviation (PSD)** – gives us the mathematical average of the weighted deviation of the test results within the grouping (similar to Total Status Deviation).

The Panel Status Deviation is the average % Status without the ±. This gives you the average deviation's size.

The PSD allows the practitioner to quickly see which panel is most deviated and may need the most attention.

2. **Panel Status Skew (PSS)** – gives us the direction of the abnormalities (positive or negative).

The Panel Status Skew is the average % Status with the ±. This gives you the average deviation's direction ±.

PSS gives meaning to the abnormality of the panel and helps suggest a potential course of action in the treatment of the abnormality.

Note: PSD flags any abnormal readings; PSS defines it.

V. Drug Interactions

This section of the LabAssist™ Interpretive Report cross-references over 200 of the most prescribed and non-prescription drugs on the market and sees if there is a potential correlation between abnormalities in the blood chemistry and drug therapy. It may also help to avoid medications that might further imbalance an already abnormal reading.

All the drugs that may have a causative relationship to an out-of-balance reading (anything with a % Status reading greater than +- 25%) are reported. The more test results that the drug may affect, the greater the number next to it.

How the Drug Interaction report is used…

1. It cross-references a large database of non-prescription and prescription drugs to the client's blood test.
2. It reports on those drugs that may cause or further exasperate already imbalanced test results.

3. It reports on the potential degree of effect of each of the drugs. The higher the number next to the drug name, the larger number of out-of-balance elements the drug may effect. If there is no number next to the drug it means only one abnormal value may be affected by that particular drug.
4. It applies the concept of biochemical individuality to each report. Each individual reacts differently to different medications, this section of the report applies this concept to drug therapy.
5. The practitioner practices smarter and faster by allowing the LabAssist™ Report to review the current literature and report potential problems medications.

VI. Nutritional Recommendations

This section gives suggestions to the practitioner as to the types of nutrients and protocols that the medical literature has reported may help balance the out-of-balance test results of the client's chemistry. A food list containing the same nutrients is also included. This section also provides a list of nutrients and foods that may ***further imbalance*** the client's blood chemistry or may have caused some of the abnormal readings.

The Report also has an age-sensitive dosage included with the nutrient recommendation. This is only a starting point and not a set-in-stone recommendation. A list of suppliers of all the nutrients in the databank is available.

How the Nutritional Recommendations Report is used…

1. *Balance*. The nutrient recommendations are not just to affect out-of-range elements but to help the practitioner help the client achieve a level of biochemical balance.
2. *Homeostasis*. The nutrient recommendations are made to allow the body to create a homeostatic environment where it can do what is necessary to achieve a higher level of health.
3. *Increase Client Compliance*. Report shows the justification for each of the nutrients recommended, which can help the client feel more in control with a better understanding of why they are taking the nutrient, thereby increasing compliance.
4. *Specificity and Biochemical Individuality*. The recommendations given are specific to the client; not a generalization based on the "average" person. This promotes the concept of biochemical individuality, the most powerful methodology of promoting better health.

VII. Clinical Correlations Section

This section "matches" clinical observations with the lab test.

Medicine has continually run blood tests on individuals with known disease states to try to get a better understanding of the mechanisms behind disease and clinical correlations. We have developed a patented methodology to cross-reference the research with the

client's blood test results and see if there are any similarities. This is **not** a diagnosis; it is a comparative correlation. It is a starting point to help the clinician make a diagnosis.

Ex: When a number of parasitic or bacterial disease patterns come up, this may call for any number of tests to ascertain whether the client may be infected.

How the Clinical Correlations Report is used...

1. It cross-references hundreds of disease patterns and matches them to the client's blood test profile.
2. It provides a potential alert to other testing protocols to better ascertain the client's health status and treatment modality.
3. It reports a potential disease match when there is a 66% or 2/3rd match with the client's blood test results.
4. It utilizes the concept of diagnostic sensitivity to use as many variables as possible to help the practitioner make a more intelligent judgment as to the client's true health status.

Remember: The patterns "match" when there is a 2/3rd or greater match between the client's chemistry and either a disease pattern or a clinical observation.

VIII. Comparison Reports

- Comparison of previous Comprehensive Blood Chemistry tests (if available)

- We can also combine dissimilar tests such as Amino Acid, and Organic Acid tests to form a more complete picture, with cross-referenced analysis.

Frequently Asked Questions

Q: Which test should I use?
A: This depends on the type of practice being addressed, as well as the disease or condition you are treating.

Q: Which test should I run first?
A: This will vary with each individual client. As a general guideline, however, we recommend initially running the Comprehensive Blood Chemistry or The Environmental Pollutants/Metabolic Panel (especially if the individual has a known history of living/working in toxic areas).

Q: If I can only do one or two tests which should they be?
A: The two we recommend are first, a comprehensive blood chemistry then, secondarily a urine organic acid test.

Q: Do I call the laboratory that ran my client's test or do I call you at Lab Interpretation?
A: Please call us at Lab Interpretation. We will often be able to provide the answers that you are looking for.

Q: Who do I call for advice?
A: You can call Hillary here at Lab Interpretation or your local sales representative.

Q: When do I order a follow-up test?
A: Depending on then extent of the individual's illness, the answer can be anywhere from 3 months to one year. If the test is being run for a relatively healthy individual, then once a year is adequate. If there are significant problems, however, then every 3 months is recommended.

Q: What are the most important supplements among those listed on the LabAssist Report?
A: Electrolytes, amino acids, and B-Complex nutrients are most commonly recommended but each person has a slightly different set of recommendations.

Q: Does insurance cover LabAssist tests?
A: Sometimes. If the client pays Lab Interpretation LLC directly, and the health care practitioner ordering the lab work is qualified to do so, than we can provide an insurance statement which they can submit to insurance directly.

Quick Tips

How to Better Use LabAssist™

General Tips

A general schedule for using LabAssist™ Report:

- 1st test to 2nd test – 90-120 days
- 2nd test to 3rd test – 180-210 days
- Subsequent tests – once per year

Of course, the time frame between tests depends on the abnormalities and other clinical decisions and may be done more often.

Basic Status Report

- Look at the 1st page and see what results represent gross disturbances in the client's chemistry

- To determine the overall status of the individual, check the bottom of the 2nd page, specifically the Total Status Deviation. This represents the average percent status deviation of all of the elements in the test. A reading over 25% for a blood chemistry, 30% for an amino acid and heavy metal/trace mineral test and 35% for a urine organic acid test are considered significant.

- The next thing to look at is the Total Status Skew. This indicates the direction of the abnormalities of the individual's blood chemistry. A negative skew indicates deficiencies while a positive skew signifies excesses.

- Whenever the Total Status Skew is less than –5.00 (-5.01 to –100.00) the addition of a multivitamin as well as an increase in nutrient-dense foods may be needed in the client's diet.

Drug Interactions

Each drug has a number next to it. This number signifies the number of elements that are out of balance (greater than 25% off), which the drug may further imbalance. Example: Aspirin (7) would signify that medical literature has shown that aspirin may cause 7 different elements in the patient's chemistry to fall further out of balance.

Panel/Subsets

- The Electrolyte Panel should be the first one you review. If it is unbalanced, the client's body will be unable to assimilate nutrients correctly and the movement of

electrolytes and nutrients (membrane traffic) in and out of the cell may be impaired.

- With the Toxicity Marker Panel, if the majority of the bars are pointing left, the client may be more susceptible to toxic events (perfume, gas fumes, etc). If the predominant shift is to the right then they may be either in, or moving toward, a toxic state.

- When all of the elements of the Differential Count are negative, this may be indicating a general mineral deficiency.

Mark Schauss, MBA, DB the major contributor to this manual is an internationally acclaimed lab expert who has spent the past twenty years creating clinically applicable interpretive reports for laboratory tests. In his two decades of research, Dr. Schauss has gained comprehensive insight into the metabolic causes and solutions for a wide range of neurological disorders, including epilepsy, autism, ADHD, neurodegenerative diseases as well as an array of other health problems. As lead developer of two US patents on disease patterning and medical diagnostic systems, Dr. Schauss has led a team to develop an interpretive laboratory report known as LabAssist™. He has lectured internationally from South America to Europe to Asia as well as in the US and Canada on laboratory testing and environmental toxicity. He has also spent the last twenty years working closely with hundreds of practitioners worldwide on the clinical applications of his unique biochemical metabolic testing interpretations. Dr. Schauss's book, ***Achieving Victory Over a Toxic World***, was published in February 2008.

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Comprehensive Blood Chemistry Test Profile

Components/Definitions

Results included in Comprehensive Blood Chemistry LabAssist Report:

A/G Ratio
Albumin
Alkaline Phosphatase
Anion Gap
B.U.N.
B.U.N./Creatinine Ratio
Basophil Count
Basophils
Bilirubin, Total
Calcium
Calcium/Phosphorus Ratio
Chloride
Cholesterol
CO2
Creatinine
Eosinophil Count
Eosinophils
Free T4 Index
GGT
Globulin
Glucose
HDL-Cholesterol
Hematocrit
Hemoglobin
Iron, Total
LDH
LDL
Lymphocyte Count
Lymphocytes
MCH
MCHC
MCV
Monocyte Count
Monocytes
Neutrophil Count
Neutrophils
Phosphorus
Potassium
Protein, Total
R.B.C.
sGOT
sGPT
Sodium
T-3 Uptake
Thyroxine (T4)
Triglycerides
Ultra-Sensitive TSH
Uric Acid
W.B.C.

Definitions/Ranges

Hematology

Hematocrit (HCT)

Hematocrit: measurement of the percentage of red blood cells in whole blood.
An important determinant of: anemia (decreased), polycythemia (increased), dehydration (elevated), increased R.B.C. breakdown in the spleen (decreased), or possible overhydration (decreased)

Normal Adult Female Range: 37 - 47 % Optimal Adult Female Value: 42 %
Normal Adult Male Range: 40 - 54 % Optimal Adult Male Value: 47 %
Normal Child Range: 29 - 43 %

Hemoglobin (HGB)

Hemoglobin: main transport of oxygen and carbon dioxide in the blood. It is composed of *globin,* a group of amino acids that form a protein and *heme* which contains iron atoms and imparts the red color to hemoglobin.
As with Hematocrit, it is an important determinant of anemia (decreased), dehydration (increased), polycythemia (increased), poor diet/nutrition, or possibly a malabsorption problem.

Normal Adult Female Range: 12 - 16 % Optimal Adult Female Value: 14 %
Normal Adult Male Range: 14 - 18 % Optimal Adult Male Value: 16 %
Normal Child Range: 10 - 15 %

MCH (Mean Corpuscular Hemoglobin)

$$\frac{\text{Hemoglobin} \times 10}{\text{R.B.C.}}$$

Mean Corpuscular Hemoglobin (MCH): gives the average weight of hemoglobin in the red blood cell. Due to its use of red blood cells in its calculation, MCH is not as accurate as MCHC in its diagnosis of severe anemias.
Decreased MCH is associated with microcytic anemia
Increased MCH is associated with macrocytic anemia.

Normal Adult Range: 27 - 33 pg Normal Child Range: 24 – 30 pg

MCV (Mean Corpuscular Volume)

$$\frac{\text{Hematocrit} \times 10}{\text{R.B.C.}}$$

Mean Corpuscular Volume (MCV): reflects the size of red blood cells by expressing the volume occupied by a single red blood cell.
Increased values may indicate macrocytic anemia or B6 or Folic Acid deficiency
Decreased values may indicate microcytic anemia, possibly caused by iron deficiency

Normal Adult Range: 80 - 100 fL Normal Child Range: 70 – 89 fL

MCHC (Mean Corpuscular Hemoglobin Concentration)

$$\frac{\text{Hemoglobin} \times 100}{\text{Hematocrit}}$$

Mean Corpuscular Hemoglobin Concentration (MCHC): measures the average concentration of hemoglobin in red blood cells. It is most valuable in evaluating therapy for anemia because Hemoglobin and Hematocrit are used, *not* R.B.C., in the calculation.
Low MCHC means that a unit of packed R.B.C.s contain less hemoglobin than normal
High MCHC means that there is more hemoglobin in a unit of R.B.C.s.
Increased MCHC is seen in spherocytosis, and not seen in pernicious anemia
Decreased levels may indicate iron deficiency, blood loss, B6 deficiency, or thalassemia

Normal Adult Range: 32 - 36 % Normal Child Range: 31 – 36 %

RBC (Red Blood Cell Count)

Red blood cells (RBCs): main function is to carry oxygen to the tissues and to transfer carbon dioxide to the lungs. This process is possible through the RBC containing hemoglobin which combines easily with oxygen and carbon dioxide.

Normal Adult Female Range: 3.9 - 5.2 mill/uL Optimal Adult Female Value: 4.55 mill/uL
Normal Adult Male Range: 4.2 - 5.6 mill/uL Optimal Adult Male Value: 4.9 mill/uL
Normal Child Range: 3.8 – 5.2 mill/uL

WBC (White Blood Cell Count)

White blood cells (WBCs): main function is to fight infection, defend the body by phagocytosis against invasion by foreign organisms, and to produce, or at least transport and distribute, antibodies in the immune response. There are a number of types of leukocytes (see differential) that are classified as follows:

Granulocytes, Nongranulocytes, Banded Neutrophils Lymphocytes, Neutrophils, Monocytes, Eosinophils, Basophils

Each cell, or leukocyte, has a different job in the body, which is explained in the Differential section. (Section 8)

Normal Adult Range: 3.8 - 10.8 thous/uL Normal Child Range: 5 – 19 thous/uL (ages 1-6)
Normal Child Range: 4.8 – 10.8 thous/uL (ages 6-16)

Electrolytes

Sodium

Sodium: the most abundant cation in the blood and its chief base. It functions in the body to maintain osmotic pressure, acid-base balance, and to transmit nerve impulses.

Normal Range: 135 - 146 mmol/L

Potassium

Potassium: the major intracellular cation in the blood. It, along with sodium, helps to maintain osmotic balance and is also involved in acid-base balance.
Needed for proper nerve and muscle action.

Normal Range: 3.5 - 5.5 mmol/L

Chloride

Chloride's significance relates to its maintenance of cellular integrity through its influence on osmotic pressure. It also helps monitor acid-base balance and water balance.
Elevated levels are related to acidosis as well as too much water crossing the cell membrane.
Decreased levels with decreased serum albumin may indicate water deficiency crossing the cell membrane (edema).

Normal Range: 95 - 109 mmol/L

CO_2 (Carbon Dioxide)

CO2 level: related to the respiratory exchange of carbon dioxide in the lungs; is part of the body's buffering system. Generally when used with the other electrolytes, it is a good indicator of acidity and alkalinity.

Normal Adult Range: 22 - 32 mmol/L Normal Child Range: 20 - 28 mmol/L

Calcium

Calcium: the most abundant mineral in the body, it is involved in bone metabolism, protein absorption, fat transfer muscular contraction, transmission of nerve impulses, blood clotting, and cardiac function. It is highly sensitive to elements such as magnesium, iron, and phosphorus as well as hormonal activity, vitamin D levels, alkalinity and acidity, and many drugs.

Normal Adult Range: 8.5 - 10.3 mg/dL Normal Child Range: 8.8 – 10.8 mg/dL

Phosphorus

Phosphorus: an abundant element found in most tissues and cells. It is closely related to the calcium level with an inverse relationship. When calcium is increased, phosphorus tends to decrease and vice versa. Needed for its buffering action, calcium transport, and osmotic pressure.
Note: Careful following of blood draw procedures are necessary because improper handling may cause falsely elevated values.

Normal Adult Range: 2.5 - 4.5 mg/dL Normal Child Range: 3.5 – 5.5 mg/dL

Liver Enzymes

sGOT (serum Glutamic-Oxaloacetic Transaminase - AST)

Serum Glutamic Oxaloacetic Transaminase or AST (Aspartate Aminotransferase): an enzyme found primarily in the liver, heart, kidney, pancreas, and muscles. Seen in tissue damage, especially heart and liver, this enzyme is normally elevated. Vitamin B deficiency and pregnancy are two instances where the enzyme may be decreased.

Normal Adult Range: 8 - 42 U/L Normal Child Range: 15 – 50 U/L

sGPT (serum Glutamic-Pyruvic Transaminase - ALT)

Serum Glutamic Pyruvic Transaminase or ALT (Alanine Aminotransferase): an enzyme found primarily in the liver but also to a lesser degree, in the heart and other tissues. It is useful in diagnosing liver function more so than sGOT levels.

Decreased sGPT in combination with increased cholesterol levels is seen in cases of a congested liver. Increased levels are also seen in mononucleosis, alcoholism, liver damage, kidney infection, chemical pollutants, or myocardial infarction.

Normal Adult Range: 5 - 48 U/L Normal Child Range: 5 – 50 U/L

Alkaline Phosphatase

Alkaline Phosphatase: produced in the cells of the bone and liver with some activity in the kidney, intestine, and placenta. Used extensively as a tumor marker it is also present in bone injury, pregnancy, or skeletal growth (elevated values). Growing children have normally higher levels of this enzyme also. Low levels are sometimes found in hypoadrenia, protein deficiency, malnutrition, and a number of vitamin deficiencies.

Normal Adult Range: 20 - 125 U/L Normal Child Range: 117 - 400 U/L

GGT (Gamma-Glutamyltransferase or Gamma-Glutamyl Transpeptidase)

Believed to be involved in the transport of amino acids and peptides into cells as well as glutathione metabolism, Gamma-Glutamyl Transferase (GGT) is mainly found in liver cells and as such is extremely sensitive to alcohol use.

Elevated levels may be found in liver disease, alcoholism, bile-duct obstruction, cholangitis, drug abuse, and in some cases excessive magnesium ingestion.

Decreased levels can be found in hypothyroidism, hypothalamic malfunction, and low levels of magnesium.

Normal Adult Female Range: 5 - 45 IU/L Normal Adult Male Range: 5 - 65 IU/L

LDH (Lactic Dehydrogenase)

Lactic dehydrogenase: an intracellular enzyme from particularly in the kidney, heart, skeletal muscle, brain, liver, and lungs.

Increases are usually found in cellular death and/or leakage from the cell or, in some cases, it can be useful in confirming myocardial or pulmonary infarction (only in relation to other tests).

Decreased levels of the enzyme may be seen in cases of malnutrition, hypoglycemia, adrenal exhaustion, or low tissue or organ activity.

Normal Range: 100 - 250 IU/L

Bilirubin, Total

A byproduct of the breakdown of hemoglobin from red blood cells in the liver, bilirubin is a good indication of the liver's function. Excreted into the bile, bilirubin gives the bile its pigmentation.

Elevated in liver disease, mononucleosis, hemolytic anemia, low levels of exposure to the sun and toxic effects to some drugs

Decreased levels are seen in people with an inefficient liver, excessive fat digestion, and possibly a diet low in nitrogen bearing foods.

Normal Range: 0 - 1.3 mg/dL

Nitrogen Elements

B.U.N. (Blood Urea Nitrogen)

BUN: the nitrogen component of urea; the end product of protein metabolism and its concentration is influenced by the rate of excretion.

Increases can be caused by excessive protein intake, kidney damage, certain drugs, low fluid intake, intestinal bleeding, exercise, or heart failure.

Decreased levels may be due to a poor diet, malabsorption, liver damage, or low nitrogen intake.

Normal Adult Range: 7 - 25 mg/dl Normal Child Range: 5 – 18 mg/dl

Creatinine

Creatinine: the waste product of muscle metabolism. Its level is a reflection of the body's muscle mass. Low levels are sometimes seen in kidney damage, protein starvation, liver disease, or pregnancy.

Elevated levels are sometimes seen in kidney disease due to the kidneys job of excreting creatinine, muscle degeneration, and some drugs involved in impairment of kidney function.

Normal Adult Range: 0.7 - 1.4 mg/dl Normal Child Range: 0.5 – 1.0 mg/dl

Uric Acid

Uric acid: the end product of purine metabolism and is normally excreted through the urine.

High levels are noted in gout, infections, kidney disease, alcoholism, high protein diets, maybe indicative of oxidative stress and with toxemia in pregnancy.

Low levels may be indicative of malabsorption, a diet low in purines, liver damage, or an overly acid kidney.

Normal Adult Female Range: 2.5 - 7.5 mg/dl Normal Adult Male Range: 3.5 - 7.5 mg/dl

Normal Child Range: 2.0 – 5.5 mg/dl

Protein

Protein, Total

Proteins are the most abundant compound in serum. The protein makeup of the individual is of important diagnostic significance because of protein's involvement in enzymes, hormones, and antibodies as well as osmotic pressure balance, maintaining acid-base balance, and as a reserve source of nutrition for the body's tissues and muscles.

The major serum proteins measured are Albumin and Globulin (alpha1, alpha2, beta, and gamma). Decreased levels may be due to poor nutrition, liver disease, malabsorption, diarrhea, or severe burns. Increased levels are seen in lupus, liver disease, chronic infections, alcoholism, leukemia, tuberculosis amongst many others. Careful review of the individual's albumin, globulin, and A/G ratio are recommended.

Normal Adult Range: 6.0 - 8.5 g/dl Normal Child Range: 5.9 – 8.1 g/dl

Albumin

Albumin: the major constituent of serum protein (usually over 50%). It is manufactured by the liver from the amino acids taken from the diet. It helps in osmotic pressure regulation, nutrient transport, and waste removal.

High levels are rarely seen and are primarily due to dehydration.

Low levels are seen in poor diets, diarrhea, fever, infection, liver disease, inadequate iron intake, third-degree burns and edemas, and hypocalcemia.

Normal Adult Range: 3.2 - 5.0 g/dl Normal Child Range: 3.5 – 5.6 g/dl

Globulin

Globulin, a larger protein than albumin, is important for its immunologic responses, especially its gamma component (IgA, IgG, IgM, and IgE). Globulins have many diverse functions such as, the carrier of some hormones, lipids, metals, and antibodies.

When chronic infections, liver disease, rheumatoid arthritis, myelomas, and lupus are present, elevated levels are seen.

Lower levels may be found in immune compromised patients, poor dietary habits, malabsorption, and liver or kidney disease.

Normal Adult Range: 2.2 - 4.2 g/dl (calculated) Normal Child Range: 2 – 4.5 g/dl (calculated)

A/G Ratio (Albumin/Globulin Ratio)

A/G ratio is an important indicator of disease states although a high level is not considered clinically significant.

Normal Range: 1.1 - 2.4 (calculated)

Protein/Globulin Ratio

Originally suggested by Dr. Hal Huggins, DDS, this ratio is use by LabAssist to judge whether the individual will respond to nutritional therapy quickly or slowly. The higher the ratio, the faster the reaction to a suggested regimen.

Normal Range: 2.1 – 3.1 (calculated)

Lipids

Cholesterol

Cholesterol: a critical fat that is a structural component of cell membrane and plasma lipoproteins, and is important in the synthesis of steroid hormones, glucocorticoids, and bile acids. Mostly synthesized in the liver, some is absorbed through the diet, especially one high in saturated fats. High density lipoproteins (HDLs) are desired as opposed to the low density lipoproteins (LDLs), two types of cholesterol.
Elevated cholesterol has been seen in artherosclerosis, diabetes, hypothyroidism, and pregnancy.
Low levels are seen in depression, malnutrition, liver insufficiency, malignancies, anemia, and infection.

Normal Adult Range: 140 - 240 mg/dl Normal Child Range: 120 – 200 mg/dl

LDL (Low Density Lipoprotein)

Low-Density Lipoprotein (LDL): the cholesterol rich remnants of the lipid transport vehicle VLDL (very-low density lipoproteins). There have been some studies correlating the association between high levels of LDL and arterial artherosclerosis. Due to the expense of direct measurement of LDL a calculation, known as the Friedewald formula is used. It is Total Cholesterol - HDL Cholesterol - (Triglycerides/5). When triglyceride levels are greater than 400 mg/dl, this calculation is not accurate.

Normal Adult Range: 62 - 130 mg/dl Normal Child Range: 50 – 110 mg/dl

HDL (High Density Lipoprotein)

High-density lipoprotein (HDL): the cholesterol carried by the alpha lipoproteins.

A high level is an indication of a healthy metabolic system if there is no sign of liver disease or intoxication. The two mechanisms that explain how HDL offers protection against chronic heart disease are that 1. HDL inhibits cellular uptake of LDL and 2. serves as a carrier that removes cholesterol from the peripheral tissues and transports it back to the liver for catabolism and excretion.

Normal Adult Range: 35 - 135 mg/dl Normal Child Range: 30 – 110 mg/dl

Triglycerides

Triglycerides, stored in adipose tissues as glycerol, fatty acids and monoglycerides, are reconverted as triglycerides by the liver. Ninety percent of the dietary intake and 95% of the fat stored in tissues are triglycerides.

Increased levels may be present in artherosclerosis, hypothyroidism, liver disease, pancreatitis, myocardial infarction, metabolic disorders, toxemia, and nephrotic syndrome.

Decreased levels may be present in chronic obstructive pulmonary disease, brain infarction, hyperthyroidism, malnutrition, and malabsorption.

Normal Adult Range: 50 - 125 mg/dl Normal Child Range: 30 – 110 mg/dl

Ratios

Anion Gap (Sodium + Potassium - CO2 - Chloride)

Anion gap: used to measure the concentration of cations (sodium and potassium) and the anions (chloride and CO2) in the extracellular fluid of the blood.

Increased measurement: associated with metabolic acidosis due to the overproduction of acids (a state of alkalinity is in effect).

Decreased levels: may indicate metabolic alkalosis due to the overproduction of alkaloids (a state of acidosis is in effect).

Normal Range: 8 - 20 (calculated)

BUN/Creatinine

BUN/Creatinine: a good measurement of kidney and liver function.

High value: normally indicative of too much B.U.N. being formed

Llow value: may show that the B.U.N. is low or that the creatinine is not being cleared effectively by the kidney.

Normal Adult Range: 6 - 25 (calculated) Normal Child Range: 6 – 35 (calculated)

Calcium/Phosphorus

Due to the delicate balance between calcium and phosphorus in the system, this calculation is helpful in noting subtle and acute imbalances in the relationship between the two elements. It also is helpful in suggesting an imbalance in magnesium as there is a relationship between all three of these essential minerals both synergistically and as antagonists to each other.

Normal Adult Range: 2.3 - 3.3 (calculated) Normal Child Range: 1.3 - 3.3 (calculated)

Sodium/Potassium

As the two major blood electrolytes, sodium as the extracellular cation and potassium as the intracellular cation, this is an important ratio to review and act upon when subtle or acute imbalances are noted.

Normal Range: 26 - 38 (calculated)

Differential

Neutrophils and Neutrophil Count

Also known as Granulocytes or poly-segmented neutrophils, this is the main defender of the body against infection and antigens.

High levels: may indicate an active infection
Low levels: may indicate a compromised immune system or depressed bone marrow (low neutrophil production.

Normal Adult Range: 48 - 73 % (Percentage) Normal Child Range: 30 - 60 % (Percentage)
Normal Adult Range: 1800-7800 (Count) Normal Child Range: 1000-6000 (Count)

Lymphocytes and Lymphocyte Count

Lymphocytes are involved in protection of the body from viral infections such as measles, rubella, chickenpox, or infectious mononucleosis.

Elevated levels may indicate an active viral infection
Depressed level may indicate an exhausted immune system or, if the neutrophils are elevated, an active infection.

Normal Adult Range: 18 - 48 % (Percentage) Normal Child Range: 25 - 50 % (Percentage)
Normal Adult Range: 800 - 4800 (Count) Normal Child Range: 1000 - 5500 (Count)

Monocytes and Monocyte Count

These cells are helpful in fighting severe infections and are considered the body's second line of defense against infection and are the largest cells in the blood stream.

Elevated levels are seen in tissue breakdown, chronic infections, carcinomas, leukemia (monocytic), or lymphomas.
Low levels are indicative of a good state of health.

Normal Range: 0 - 9 % (Percentage)

Eosinophils and Eosinophil Count

Eosinophils are used by the body to protect against allergic reactions and parasites.
Elevated levels may indicate an allergic response.
Low counts are normal.

Normal Range: 0 - 5 % (Percentage) Normal Range: 50-550 (Count)

Basophils and Basophil Count

Basophilic activity is not fully understood but it is known to carry histamine, heparin, and serotonin.

High levels are found in allergic reactions,
Low levels are normal.

Normal Range: 0 - 2 % (Percentage) Normal Range: 0-200 (Count)

Thyroid

Thyroxine (T4)

Thyroxine is the thyroid hormone that contains four atoms of iodine. It is used to evaluate thyroid function.
It is the direct measurement of total T4 concentration in the blood serum.
Increased levels are found in hyperthyroidism, acute thyroiditis, and hepatitis.
Low levels can be found in Cretinism, hypothyroidism, cirrhosis, malnutrition, and chronic thyroiditis.

Normal Range: 4 - 12 ug/dL

T3-Uptake

This test is an indirect measurement of unsaturated thyroxine binding globulin in the blood.

Increased levels are found in hyperthyroidism, severe liver disease, metastatic malignancy, and pulmonary insufficiency.
Decreased levels are found in hypothyroidism, normal pregnancy, and hyperestrogenis status.

Normal Range: 27 - 47%

Free T4 Index (T7)

This index is a calculation used to correct the estimated total thyroxine for the amount of thyroxine binding globulin present. It uses the T4 value and the T-uptake ratio.

Normal Range: 4 - 12

Thyroid Stimulating Hormone (TSH)

TSH, produced by the anterior pituitary gland, causes the release and distribution of stored thyroid hormones. When T4 and T3 are too high, TSH secretion decreases, when T4 and T3 are low, TSH secretion increases.

Normal Range: 1.1 – 2.5 mIU/L

Free T4

Although free thyroxine is only a small fraction of total thyroxine it is the metabolically active form of this hormone.
Low free T4 may be indicative of hypothyroidism or a dysregulation of the production of T3. It could also indicate a lack of iodine.
An elevated result is commonly associated with Grave's disease or thyrotoxicosis.

Normal Range: .8 – 1.8 ng/dL

Free T3

Existing in a free state (unbound to protein) free triiodothyronine measurements are helpful in determining thyroid function.
Low readings are found in hypothyroidism and in the third trimester of pregnancy.
Elevated readings are commonly found in hyperthyroidism, T3 toxicosis and peripheral resistance syndrome.

Normal Range: 230 – 420 pg/dL

Other

Glucose (Fasting)

Glucose, formed by the digestion of carbohydrates and the conversion of glycogen by the liver, is the primary source of energy for most cells. It is regulated by insulin, glucagon, thyroid hormone, liver enzymes, and adrenal hormones.
Elevated levels: in diabetes, liver disease, obesity, pancreatitis, due to steroid medications, or during stress.
Low levels: may be indicative of liver disease, overproduction of insulin, hypothyroidism, or alcoholism.

Normal Adult Range: 60 - 109 mg/dL

Iron, Total

Iron is necessary for the formation of some proteins, hemoglobin, myoglobin, and cytochrome. Also, it is necessary for oxygen transport, cellular respiration, and peroxide deactivation.
High levels are seen in hemochromatosis, liver damage, pernicious anemia, and hemolytic anemia.
Low levels are seen in many anemias, copper deficiencies, low vitamin C intake, liver disease, chronic infections, high calcium intake, and women with heavy menstrual flows.

Normal Adult Range: 30 - 170 ug/dl Normal Child Range: 30 – 140 ug/dl

Vitamin D, 25-OH, D3

Vitamin D3, also known as cholecalciferol is a fat soluble nutrient that is primarily known for its role in the regulation of calcium and bone growth but it has been reported to be involved in numerous other biological processes including immune support.
Low readings are common and typically respond readily to supplementation.
High results may indicate over supplementation.

Plasma Amino Acids Test Profile
Components/Definitions

1-Methylhistidine

High Results: may be indicative of inadequate methyl group transfer or impaired methionine metabolism. If 3-Methylhistidine is also elevated, consider using TMG (trimethylglycine).
Low Results: may be indicative of a vitamin B12 or folic acid deficiency.

3- Methylhistidine

High Results: may be indicative of the need for additional antioxidants.
Low Results: low readings have not been correlated with any abnormal health or metabolic conditions.

Alanine

Alanine is considered a non-essential amino acid which is derived from the conversion of the carbohydrate pyruvate and the breakdown of DNA and/or carnosine and anserine. Found in high concentration in muscle tissue.
High Results: elevated levels can antagonize taurine. It may be indicative of hypoglycemia or excessive exercise. Possible inefficient energy production.
Low Results: may be found in individuals with low branched chain amino acids (BCAA). May be indicative of hypoglycemia.

α –Aminoadipic Acid

This intermediate of the catabolic breakdown of lysine when elevated may be indicative of an increased risk for cardiovascular disease. It is dependent of pyridoxine (B6) and α-ketoglutarate.
High Results: may be indicative of an inhibition of lysine metabolism and may necessitate the supplementation of B6.
Low Results: have not been correlated with any abnormal health or metabolic conditions.

α-Amino-N-Butyric Acid

α-Amino-N-Butyric acid is a metabolite of threonine and requires pyridoxine (B6) and α-ketoglutarate for complete oxidation.
High Results: may be indicative of poor cellular energy generation. May also show abnormalities in the citric acid cycle.
Low Results: may be indicative of a B6 and zinc deficiency especially in the presence of high threonine.

Anserine

Anserine is a dipeptide similar to carnosine and is found predominantly in poultry. It requires zinc for proper metabolism.

High Results: may be due to high dietary intake of poultry or zinc deficiency.

Low Results: have not been correlated with any abnormal health or metabolic conditions.

Arginine

Arginine, an essential amino acid in childhood (it can be synthesized by adults) has been used to improve cardiovascular health, immune function (not herpes virus), and protein metabolism throughout the body.

High Results: may be due to a dysfunction of the urea cycle. It can also be due to a genetic disorder tied to an arginase enzyme deficiency.

Low Results: may be due to poor diet, especially poor quality protein sources as well as eating foods rich in lysine (meats and dairy). A deficiency in arginine may also lead to a higher risk of cardiovascular disease.

Asparagine

Asparagine is a non-essential amino acid synthesized from aspartic acid and ATP.

High Results: may be indicative of a protein synthesis disorder.

Low Results: may be indicative of a functional magnesium deficiency.

Aspartic Acid

Aspartic acid is a non-essential amino acid made from glutamate utilizing vitamin B6 in this conversion. It is involved in the urea and Krebs cycle (ammonia metabolism and carbohydrate metabolism). An excitatory amino acid, aspartic acid has been studied for the treatment of unipolar depression. This reading may be indicative of the inability to detoxify, especially ammonia.

High Results: some neurological disorders such as stroke or epilepsy may be the result or aftermath of a high aspartic acid.

Low Results : Fatigue may result from low levels.

ß-Alanine

ß-alanine is found primarily in the brain and is a component of carnosine, anserine, and pantothenic acid (B5).

High Results: may be indicative of Candida albicans or other intestinal flora.

Low Results: may be indicative of a pantothenic acid deficiency.

ß-Aminoisobutyric Acid

High Results: may indicate a lack of transaminase enzyme. Also may show a possible protein deficiency.

Low Results: have not been correlated with any abnormal health or metabolic conditions.

Carnosine

Carnosine is a dipeptide typically formed in skeletal muscle. It is found in rich supply in pork.
High Results: may be indicative of zinc deficiency. Genetic deficiency may lead to neurological development problems and sensory polyneuropathy.
Low Results: have not been correlated with any abnormal health or metabolic conditions.

Citruline

High Results: may indicate a block in the urea cycle and inability to detoxify ammonia. A lower dietary protein intake may help.
Low Results: have not been correlated with any abnormal health or metabolic conditions.

Cystathionine

Cystathionine is an important sulfur amino acid and is the byproduct of the degradation of honocysteine. It is dependent on vitamin B6 for this function.
High Results: may be due to a functional B6 deficiency. May also be indicative of an increased need for antioxidants.
Low Results: may be indicative of generally low sulfur containing amino acids. Cross correlate this result with taurine. May also show impaired glutathione production.

Cystine

Cystine is the combination of two cysteine molecules combine. A sulfur amino acid, it is critical in the ability to detoxify the body. It also is essential in energy metabolism and fatty acid metabolism.
High Results: may be caused by impaired cysteine metabolism. Potential riboflavin or copper deficiency.
Low Results may be due to a deficiency in methionine or cysteine.

Thanolamine

Ethanolamine is the precursor to acetylcholine synthesis and is converted to phosphoethanolamine in a magnesium dependent reaction.
High Results: Poor serine conversion, possible low acetylcholine synthesis due to a magnesium deficiency, especially if phosphoethanolamine is low. Consistently high plasma levels may be indicative of poor wound healing.

Low Results: have not been correlated with any abnormal health or metabolic conditions.

GABA (Gamma-Aminobutryric Acid)

GABA is known as a neuroinhibitory amino acid that is derived from glutamic acid and ornithine and seems to regulate nerve cell function.
High Results: may be due to missing co-factors within the Krebs or citric acid cycle.

Low Results: it is an inhibitory neurotransmitter in the central nervous system. Low levels are found in depressed patients as well as neurodegenerative diseases.

Glutamic Acid

Glutamic acid is considered a excitatory neurotransmitter. It is critical in removing excess ammonia from the brain as well as helping deal with symptoms such as headache, irritability, and fatigue.
High Results: may be indicative of possible liver dysfunction.
Low Results: may be indicative of hyperammonemia especially if high glutamine is present.

Glutamine

Glutamine is abundant in both blood and cerebrospinal fluid and easily passes the blood-brain barrier. This amino acid also acts as a detoxifier of ammonia from the brain and may be a protector against certain bacteria and alcohol poisoning.

High Results: may indicate ammonia toxicity.
Low Results: may be indicative of poor absorption of proteins.

Glycine

Glycine plays an important role in the body's ability to detoxify itself as well as in wound healing. It is also important in the creation of nucleic acids and bile acids. This amino acid is non-essential as it can be synthesized from serine and threonine.
High Results: may be indicative of poor oxidation or gluconeogenesis.
Low Results: may be indicative of poor nitrogen retention or a low intake of quality proteins.

Histidine

Histidine is an essential amino acid in infants (not adults) important as a mild anti-inflammatory, especially in cases of rheumatoid arthritis.
High Results: excessive protein intake or muscle breakdown occurring if 3-methylhistidine is high.
Low Results: may be indicative of poor protein absorption or low dietary intake.

Homocysteine

A relationship between homocysteine and homocystine occurs as they are closely correlated and may indicate the need for additional folate and B12.
High Results: may be indicative of a higher risk of coronary heart disease (atherosclerosis), neurological, ocular, or musclo-skeletal disorders.
Low Results: low readings have not been correlated with any abnormal health or metabolic conditions.

Hydroxylysine

Hydroxylysine is a derivative of lysine and is used to create collagen. It uses cofactors such as vitamin C, iron and α-ketoglutarate.

High Results: may be indicative of connective and bone tissue breakdown or the use of a blood thinner such as Coumadin. A high level may also be found in a number of degenerative diseases.

Low Results: low readings have not been correlated with any abnormal health or metabolic conditions.

Hydroxyproline

Hydroxyproline is a component of collagen derived from proline.

High Results: may be indicative of bone resorption problems.

Low Results: low readings have not been correlated with any abnormal health or metabolic conditions.

Isoleucine

Isoleucine is one of the branched chain amino acids (BCAAs), a group of essential amino acids (with leucine and valine) involved in handling of stress, energy production, and muscle metabolism. Balanced supplementation of BCAAs has been reported to be effective in chronic liver disease, anorexia, recovery from surgery, and endocrine functioning.

High Results: may be due to high intake of amino acids or the inability to breakdown or metabolize dietary proteins.

Low Results: could be indicative of hypoglycemia, loss of muscle mass or the inability to build muscle.

Leucine

Leucine is one of the branched chain amino acids (BCAAs), a group of essential amino acids (with isoleucine and valine) involved in handling of stress, energy production, and muscle metabolism. Balanced supplementation of BCAAs has been reported to be effective in chronic liver disease, anorexia, recovery from surgery, and endocrine functioning.

High Results: A high plasma leucine may be due to incomplete metabolism of dietary amino acids or excessive intake of protein.

Low Results: A low plasma level of leucine may be indicative of catabolization of skeletal muscle. Especially true if 3-methylhistidine is high.

Lysine

Lysine, an essential amino acid, is crucial in carbohydrate metabolism and the creation of the amino acids citrulline and carnitine, as well as in the development of collagen.

High Results: may be due to impaired metabolism due to low vitamin C, B6 and/or iron.

Low Results: may be due to poor dietary intake and/or excessive intake of arginine and/or ornithine. May inhibit collagen production.

Methionine

An essential amino acid, you can only get methionine from dietary or supplemental sources. It is important that adequate vitamin B6 is available; otherwise methionine may over convert to homocysteine and throw arginine and/or ornithine out of balance.

High Results: It has been reported that too much of this sulfur amino acid may increase the production of polyamines which may promote the growth of cells. Excessive intake of methionine or poor metabolism may be found when elevations of plasma methionine are found.

Low Results: may be indicative of poor dietary intake of protein or poor quality of protein. May adversely affect sulfur metabolism.

Ornithine

Ornithine is an important amino acid, especially in promoting cellular growth. Since it is the precursor to both citrulline and arginine, it has many similar biological effects.

High Results: may indicate a metabolic block in the urea cycle which may cause a buildup of ammonia.

Low Results: may be indicative of low intake of arginine. It may also affect cellular metabolism. Hyperammonemia may also occur with depressed ornithine levels.

Phenylalanine

Phenylalanine is an essential amino acid and is converted to tyrosine in the liver by phenylalanine hydroxylase. Nutrients needed for this amino acid's metabolism are folic acid, iron, niacin, pyridoxine, copper, and vitamin C.

High Results: may be caused by an excessive intake of protein, a block in the conversion of phenylalanine to tyrosine, or iron deficiency.

Low Results: may be indicative of altered thyroid function or catecholamine deficits. Symptoms may include depression, memory loss, fatigue, cognitive disorders, stress, and autonomic dysfunction.

Phosphoethanolamine

A precursor to the creation of acetylcholine it is a metabolite of phospholipid metabolism.

High Results: possible inhibition of choline and acetylcholine synthesis due to impaired methionine metabolism.

Low Results: Low readings have not been correlated with any abnormal health or metabolic conditions.

Phosphoserine

Converted from serine, this peptide is found in high levels in Parkinson’s patients.

High Results: may be due to a functional deficiency in magnesium if serine is low.

Low Results: Low readings have not been correlated with any abnormal health or metabolic conditions.

Proline

Proline is the major constituent of collagen and is important in ammonia detoxification and citric acid cycle function.

High Results: may be indicative of poor utilization of proline. If glutamate is low, may be indicative of a niacin deficiency.

Low Results: may be indicative of a defect in connective tissue synthesis.

Sarcosine

Also known as N-methylglycine it can be a marker for severe folate deficiency (folate is required to convert N-methylglycine into glycine).

High Results: may be indicative of a functional deficiency of riboflavin (B2). This in turn may impair vitamin B6 metabolism and the conversion of tryptophan to niacin.

Low Results: Low readings have not been correlated with any abnormal health or metabolic conditions.

Serine

Serine is a key amino acid can be converted to glycine and vice versus. It is crucial in the production of many neurotransmitters. It is also important in DNA synthesis, gluconeogenesis and in the creation of many hormones and enzymes.

High Results: may be indicative of glucogenic compensation and catabolism if threonine is low.

Low Results: a low result may be indicative of a deficit in acetylcholine synthesis, or methionine metabolism.

Taurine

Taurine is known as an inhibitory amino acid because of its ability to control excitable tissues and its use in seizure activity. It also is helpful in cases of congestive heart disease as well as in the prevention of stroke.

High Results: may be due to an inflammatory condition or over supplementation of other amino acids.

Low Results: may be indicative of oxidative stress, fat maldigestion, arthrosclerosis, angina, seizure disorders, or arrhythmias. Females are more likely to have a taurine synthesis problem than males.

Threonine

Threonine is an essential amino acid which the body breaks down to form glycine, serine and glucose. Research has been done on the positive impact of threonine on the immune system and in depression.

Low Results: a low result may be indicative of hypoglycemia if glycine and serine are also low.

High Results: may be due to excessive dietary intake or insufficient metabolism of threonine.

Tryptophan

Tryptophan metabolism requires B6, folic acid, and magnesium. Also, niacin and glutamine are important requirements for normal metabolism. Niacin can be made from tryptophan.

High Results: may be due to improper metabolism of tryptophan.

Low Results: a low result may be indicative of depression and insomnia.

Tyrosine

Tyrosine is an important amino acid in dealing with stress, fatigue, ADD, depression, blood pressure disorders, and hypothyroidism. It is a precursor to thyroid and adrenocortical hormones and dopamine.

High Results: Inadequate utilization of tyrosine may be the cause of elevated levels.

Low Results: Low levels are found in many of the aforementioned conditions.

Valine

Valine is one of the branched chain amino acids (BCAAs) a group of essential amino acids (with leucine and isoleucine) involved in handling of stress, energy production, and muscle metabolism. Balanced supplementation of BCAAs has been reported to be effective in chronic liver disease, anorexia, recovery from surgery, and endocrine functioning.

Low Results: a low plasma level of valine may be due to muscle loss or inadequate stomach acid if other essential amino acids are also low.

High Results: may be due to excessive dietary or supplemental intake or a functional B6 deficiency.

Organic Acid/Environmental Pollutants Test Profile Components/Definitions

Urinary Metabolic Markers (Urine Organic Acids and Environmental Pollutants Biomarkers)

2-Hydroxyphenylacetate

A metabolite of some pathogens, possibly E coli, it should only be found in background levels.
High Results: Elevations of 2-Hydroxyphenylacetate may be indicative of uremia, gastrointestinal pathology, liver dysfunction, digestive problems or compromised energy production.
Low Results: No known health issues are related to low levels of 2-Hydroxyphenylacetate.

2-Methylhippurate

This organic acid is an indication of exposure to or xylene or toluene. A comprehensive detoxification program should be undertaken to help the body excrete these petrochemicals. The use of antioxidants and glycine are recommended.
High Results: indicate exposure to toluene and/or xylene although low levels may indicate an inability to excrete this toxic metabolite.
Low Results: Low levels are desirable.

3,4-Dimethylhippurate

High Results: 3,4-Dimethylhippurate is a marker for exposure to trimethylbenzene a common solvent found in paint thinners, dry cleaning, pesticides, inks, asphalt, lacquers, varnishes, dyes and many other petrochemical based products. Some health effects include dizziness, headache, anxiety, nausea, blurred vision, abdominal pains along with difficulty concentrating and irritability. Irritation of mucous membranes, dermatitis, nervousness and fatigue are other potential effects of trimethylbenzene exposure.
This toxin is also known to be carcinogenic and hepatotoxic.
In order to help the body excrete trimethylbenzene it is suggested to increase intake of glycine and sulfur bearing amino acids such as N-acetyl-cysteine and taurine. This, along with an increased fluid intake is necessary to help the body excrete this toxin. The use of saunas as well as exercise may also be beneficial in some people to excrete solvents from adipose tissue.
Low Results: A low reading is desirable for this marker, although it may indicate an inability to excrete the solvent trimethylbenzene.

3-Indoleacetate

A common marker for dysbiosis, 3-indoleacetate should only be found in low, background levels.
High Results: Elevations of 3-indoleacetate may be indicative of gastrointestinal pathology, liver dysfunction, digestive problems or compromised energy production.
Low Results: No known health issues are related to low levels of 3-Indoleacetate.

3-Methylhippurate

High Results: This metabolic byproduct of the excretion of xylene may indicate of exposure to this prevalent solvent. A comprehensive detoxification program should be undertaken to help the body excrete these petrochemicals. The use of antioxidants and glycine are recommended. Xylene may cause problems with the central nervous system. This effect will impair performance and affect cerebral function. Other symptoms are erythema, defatting dermatitis, conjunctivitis, renal damage, and paresthesias of the extremities.
Xylene has also been suggested as causing mild hematopoietic system toxicity in experimental animals. Research suggests that this petrochemical is metabolized at a half-life rate of approximately 25 hours. The balance of the exposure is metabolized by the oxidation of a methyl group to toluic acid. The toluic acid is converted to methylhippuric acid through conjugation with glycine and excreted in the urine.
Low Results: Low levels are desirable as high levels would be an indication of exposure to xylene although this does not rule out exposure and/or storage of this toxin.

5-Hydroxyindoleacetate

A breakdown metabolite of serotonin, 5-hydroxyindoleacetate is dependent on tryptophan and may indicate a deficiency when low.
High Results: An elevation of this metabolite of the breakdown of serotonin may be due to the use of serotonin-specific re-uptake inhibitor (SSRI) drugs or the release of serotonin from the central nervous system, intestinal argentaffin cells or platelets.
Low Results: A metabolite of serotonin, this organic acid may be indicative of low tryptophan. Clinical signs include depression, fatigue, insomnia, ADD, and other behavioral disorders.

8-Hydroxy-2'-Deoxyguanosine (8-OHDG)

A urinary marker of the oxidation of DNA.
High Results: indicate an increased rate of oxidative damage to DNA.
Low Results: No known health disorders are related to low levels of this marker.

Adipate

Adipate is a byproduct in the oxidation of fatty acids and a marker for carnitine deficiency.
High Results: may be indicative of a disorder of fatty acid oxidation. Clinical symptoms may include weakness, nausea, hypoglycemia, recurrent infections, and sweaty feet odor.

Low Results: No known health issues are related to low levels of adipate.

α-Hydrozybutyrate

This organic acid is the last step of glutathione synthesis from methionine through cysteine.
High Results: seen in poor carbohydrate metabolism as well as in elevated glutathione synthesis possibly due to toxicity, intestinal dysbiosis, drug interactions such as acetaminophen, and any disease that increases glutathione demands. Review pyroglutamate and sulfate levels to determine the stage of glutathione depletion.
Low Results: Low levels are desirable but not indicative of any positive or negative health issues.

α-Ketoglutarate

The byproduct of the oxidation of isocitrate within the citric acid cycle, this urinary metabolite is also formed in the breakdown of glutamic acid, histidine, arginine, proline and glutamine.
High Results: may be indicative of poor amino acid metabolism or a need for both B-complex and lipoic acid.
Low Results: may be indicative of poor amino acid metabolism, decreased intake increased fatty acid synthesis an increase of palmitic acid in plasma and red blood cell membranes. You should look at the levels of serum triglycerides as well to verify the fatty acid synthesis problem.

α-Ketoisocaproate

α-Ketoisocaproate is formed from the branch chain amino acid leucine.
High Results: This organic acid may be elevated due to poor amino acid metabolism. Supplementation with a B complex may be necessary as well as additional intake of thiamine (B1).
Low Results: No known health issues are related to low levels of α-Ketoisocaproate.

α-Ketoisovalerate

α-Ketoisovalerate is formed from the branch chain amino acid valine.
High Results: This organic acid may be elevated due to poor amino acid metabolism. Supplementation with a B complex may be necessary as well as additional intake of thiamine (B1).
Low Results: No known health issues are related to low levels of α-Ketoisovalerate.

α-Keto-ß-Methylvalerate

α-Keto-β-Methylvalerate is formed from the branch chain amino acid leucine.
High Results: This organic acid may be elevated due to poor amino acid metabolism. Supplementation with a B complex may be necessary as well as additional intake of thiamine (B1).
Low Results: No known health issues are related to low levels of α-Ketoisovalerate.

Benzoate

Benzoate, commonly found in foods as a preservative, is a marker for Phase I detoxification or from the action of intestinal bacteria on phenylalanine.

High Results: An elevated reading of this organic acid may mean an overgrowth of certain intestinal microbiota, ingestions of excessive benzoic acid in the diet (preserved foods, pickles, lunch meats, cranberries), or poor Phase II detoxification capabilities as the conjugation of benzoate with glycine is very efficient. The presence of this compound may be due to the action of the bacteria on phenylalanine. Assessment of amino acid competency may be helpful especially plasma glycine.

Low Results: A low reading is not normally significant. It may indicate poor Phase I detoxification although this is somewhat theoretical.

ß-Hydroxybutyrate

A ketone body that may indicate metabolic acidosis when excessively elevated.

High Results: may be indicative of poor carbohydrate metabolism, poor glucose utilization, or excessive oxidation of free fatty acids. Another possibility is a defect in cytochrome oxidase enzymes.

Low Results: No known health issues are related to low levels of ß-hydroxybutyrate.

ß-Hydroxyisovalerate

A distinct marker for biotin deficiency, it is a metabolite of the catabolism of the amino acid isoleucine.

High Results: an increased reading of this organic acid may be indicative of a functional biotin deficiency. Overuse of antibiotics, dysbiosis, the use of anticonvulsant drugs, and/or pregnancy may also be a cause of these high results.

Low Results: No known health issues are related to low levels of ß-hydroxyisovalerate.

cis-Aconitate

cis-Aconitate, along with citrate and isocitrate are important central energy pathway markers.

cis-Aconitiate: a citric acid cycle intermediate

Low Results: No known health issues are related to low levels of cis-Aconitate

High Results: may be an indication of poor supplies or metabolism of amino acids. If elevated with orotate, isocitrate and citrate, suspect hyperammonemia.

Citramalate

Citramalate is a possible fungal marker.

High Results: Elevated levels have been seen in children with autistic traits and have been suggested as a marker for dysbiosis although these findings are not strongly supported by the literature.

Low Results: No known health issues are related to low levels of Citramalate.

Citrate

Citrate along with cis-Aconitate and isocitrate are important central energy pathway markers.

High Results: may be indicative of an amino acid deficiency, hyperammonemia, cytochrome C oxidase deficiency or a problem with amino acid metabolism.

Low Results: may be indicative of an amino acid deficiency or a problem with metabolism. Also, a low level is linked to a increased risk of kidney stones, both the calcium and cysteine related stones.

DHPP – Dihydroxyphenylpropionate

DHPP is a metabolite of clostridium or Escheria coli.

High Results: may occur with an overgrowth of Clostridium and possibly E-coli. There are approximately 100 species of Clostridium, 50 of which are known to be pathogenic.

Low Results: No known health issues are related to low levels of DHPP.

D-Lactate

D-Lactate elevations may indicate an acidotic gut flora due to the overgrowth or over-supplementation of acidophilus.

High Results: may indicate that there may be an overgrowth of Lactobacillus acidophilus, plantarum or salivarius. High dietary carbohydrate intake or antibiotic use are other possibilities.

Low Results: No known health issues are related to low levels of D-Lactate.

D-Arabinitol

D-Arabinitol is a marker for the presence of yeast.

High Results: D-Arabinitol is a senstive marker for the presence of yeast in the small intestine. An elevated reading is indicative of an ongoing yeast infection.

Low Results: No known health issues are related to low levels of D-arabinitol.

Ethylmalonate

A byproduct in the oxidation of fatty acids and a marker for carnitine deficiency.

High Results: elevated in carnitine and riboflavin deficiency which may lead to the inability to oxidize long-chain fatty acids and amino acids. If adipate is also elevated may indicate severe fatty acid oxidation impairment.

Low Results: No known health issues are related to low levels of ethylmalonate.

Formiminoglutamic Acid (FIGLU)

FIGLU is derived from the amino acid histidine and shows a potential for folate deficiency before symptoms occur.

High Results: suggestive of a folic acid deficiency. FIGLU is a compound derived from histidine and an insufficiency of folic acid leads to a high result.

Low Results: No known health issues are related to low levels of FIGLU.

Fumarate

A part of the citric acid cycle fueled by tyrosine and phenylalanine, an abnormal reading of fumarate may indicate a depletion in available amino acid reserves.

High Results: may be indicative of a Coenzyme Q10 deficiency or if citrate, malate, and α-ketoglutarate are also elevated then suspect a cytochrome C oxidase deficiency.

Low Results: Indicative of poor functioning or overstress on the citric acid cycle, a low reading of this organic acid may be suggestive of low levels of tyrosine and phenylalanine.

Glucarate

Glucarate is a by-product of oxidation in the Phase 1 detoxification process involving cytochrome p450.

High Results: may be indicative of toxic exposures, especially pesticides. Glycine and N-acetyl-cysteine are helpful supplements in reducing this reading. Elevations may also be seen in alcoholism, solvent exposure, excessive estrogen and/or testosterone and drugs such as aspirin, lorazepam, digoxin and morphine.

Low Results: may be indicative of a reduced overall liver function and possible downregulated Phase I detoxification capability.

Hippurate

Hippurate is the by-product of the conjugation of benzoate and glycine. Low readings may indicate an inability to bind petrochemical solvents while a high reading may suggest on-going environmental toxin exposure.

High Results: may be indicative of an overgrowth of intestinal microbiota due to the action of bacteria on phenylalanine, elevated levels of environmental toxins (typically solvents) or elevated ingestion of benzoic acid.

Low Results: Low hippurate is not typically indicative of any problems except when benzoate is elevated, which would suggest poor conjugation with glycine and possibly impaired Phase II detoxification capacity. If low in an Environmental Pollutants Biomarker Panel, it may be related to an inability to excrete solvents.

Homovanillate

A part of the catecholamine pathway, homovanillate elevations may be due to environmental toxins and depressions may indicate low levels of the amino acid phenylacetate.

High Results: Elevated levels of homovanillate may be due to amino acid deficiencies, the use of L-Dopa as a treatment for Parkinson's disease, copper deficiency, cocaine or amphetamine use or chronic depletion of tyrosine.

Low Results: may be related to low CNS levels of epinephrine and norepinephrine. Clinical signs include depression, sleep disturbances, and the inability to handle stress and fatigue.

Hydroxymethylglutarate

HMG is a metabolic precursor of coenzyme Q10 and cholesterol.

High Results: may be indicative of a low level of Coenzyme Q10, statin drug use or mitochondrial dysfunction.

Low Results: may be indicative of a low level of Coenzyme Q10 or poor synthesis due to the inhibition of HMG-CoA reductase.

Isocitrate

A citric acid cycle component, isocitrate along with citrate and cis-aconitate dysfunction can be indicative of poor energy production.

High Results: may be due to mitochondrial dysfunction, poor functioning of the citric acid cycle, gentamicin toxicity or, if citrate, cis-aconitate and orotate are elevated, an ammonia clearance disorder and possibly arginine deficiency.

Low Results: indicative of inadequate supplies of amino acids.

Kynurenate

A by-product of the breakdown of the amino acid tryptophan

High Results: A high reading is consistent with a vitamin B6 deficiency, possible inflammatory processes, interferon-gamma stimulated macrophages or excessive tryptophan supplementation (not 5-HTP). Abnormally high levels can cause and increase in pain sensations and may, in multiple sclerosis patients, be a marker for an exacerbation period.

Low Results: No known health issues are related to low levels of kyurenate.

Lactate

A metabolic precursor to the citric acid cycle

High Results: may indicate a block in the production of energy, a Coenzyme Q10, biotin, thiamine or lipoic acid deficiency, an on-going infectious state, use of some recreational and/or pharmaceutical drugs, alcohol over consumption, poor blood sugar control (especially with diabetics), and a number of inborn errors of metabolism.

Low Results: may be indicative of a low level of physical activity or in high performance athletes.

Malate

Derived from fumarate in the citric acid cycle, abnormal malate levels may indicate a disruption of energy production.

High Results: may be indicative of a need for certain nutrients such as niacin and Coenzyme Q10. If citrate, fumarate, and α-ketoglutarate are high as well, it may be due to a cytochrome C oxidase deficiency. Elevations of malate are also seen in individuals with Syndrome X. Tartaric acid has also been implicated, although theoretically, to block malate within the citric acid cycle.

Low Results: may be due to poor protein nutrition or metabolism as well as a strain on the citric acid cycle.

Mandelate

Mandelic acid, along with phenylglyoxylate is a marker for styrene exposure. Primarily used in packaging, this petrochemical is made from a combination of benzene and ethylene. Styrene is also found in cigarette smoke, making smokers more likely to suffer side-effects.

High Results: Some health effects include dizziness, lightheadedness, headache, drowsiness, nausea, impaired balance and manual dexterity along with difficulty concentrating and poor reaction time. Irritation of mucous membranes, dermatitis, nausea and fatigue are other potential effects of styrene exposure. Styrene is also known to be genotoxic and hepatotoxic. It has been suggested that this toxin may also increase the risk for a number of cancers including leukemia. In animal models, low levels can be extremely hepatotoxic to some while not to others. This suggests a genetic component to styrene excretion. To help the body excrete styrene it is suggested that boosting glutathione levels may be helpful as styrene oxides conjugate with this tripeptide.

Low Results: A low reading is desirable. A low level may also be indicative of an inability to excrete this potent solvent toxin.

Methylmalonate

Part of the breakdown of the amino acid valine, it is B12 dependent.

High Results: may be due to a functional B12 deficiency. Reasons may include alcoholism, aging, gut dysbiosis, or a methyl tetrahydrofolate reductase deficiency.

Low Results: No known health issues are related to low levels of methylmalonate.

Monoethyl Phtalate

Phthalates are used in the manufacture of plastics to allow for flexibility and to soften resins. Not only that, but they are found in everything from makeup to detergents, shampoos to time-released pharmaceutical drugs.

High Results: This toxin is a well known endocrine disruptor as well as causing neurological and developmental disorders. It can interfere with tryptophan metabolism resulting in an increase in quinolinic acid, a pro-inflammatory and neurotoxic compound. Phthalates have also been implicated in abnormal fetal development, especially in male fetuses.

Low Results: No known health issues are related to low levels of monoethyl phthalates. It may also be indicative of the inability to excrete phthalates.

Orotate

Orotate is a marker for arginine deficiency and is an indicator of the efficiency of the urea cycle which helps the body remove excessive ammonia from the metabolism of amino acids and proteins.

High Results: may be due to an arginine deficiency, ammonia intoxication, and by excessive lysine intake as well as an intracellular magnesium deficiency. Arginine, aspartic acid, alpha ketoglutarate, and magnesium may be helpful.
Low Results: No known health issues are related to low levels of orotate.

Oxalate

Oxalates are naturally-occurring substances found in plants, animals, and in humans.
High Results: may be indicative of the development of oxalate stones (typically calcium oxalate) in the kidney. The use of citrate bound supplements may be helpful in lowering oxalates.
Low Results: Low levels of oxalate have not been linked to any known health disorder. High citrate may inhibit oxalate levels in the system as well.

Phenylacetate

Phenylacetate is a metabolite of a dysbiotic gut.
High Results: may be indicative of an overgrowth of intestinal microbiota or protozoa. The presence of this acid may be due to the action of bacteria on phenylalanine and should not appear in anything more than background amounts.
Low Results: No known health issues are related to low levels of phenylacetate.

Phenylglyoxalate

Phenylglyoxylic acid, along with mandelate is a marker for styrene exposure. Primarily used in packaging, this petrochemical is made from a combination of benzene and ethylene. Styrene is also found in cigarette smoke making smokers more likely to suffer side-effects.
High Results: Some health effects include dizziness, lightheadedness, headache, drowsiness, nausea, impaired balance and manual dexterity along with difficulty concentrating and poor reaction time. Irritation of mucous membranes, dermatitis, nausea and fatigue are other potential effects of styrene exposure. Styrene is also known to be genotoxic and hepatotoxic. It has been suggested that this toxin may also increase the risk for a number of cancers including leukemia. In animal models, low levels can be extremely hepatotoxic to some while not to others. This suggests a genetic component to styrene excretion. In order to help the body excrete styrene it is suggested to increase intake of glutathione as styrene oxides conjugate with this tripeptide.
Low Results: While a low reading of this metabolite of styrene is desirable, it may indicate the inability to excrete this toxic solvent.

Phenylpropionate

Phenylpropiontate is a metabolite of a dysbiotic gut.

High Results: may be indicative of an overgrowth of intestinal microbiota, protozoa or malabsorption of phenylalanine from the diet due to HCL deficiency. The presence of this acid may be due to the action of bacteria on phenylalanine and should not appear in anything more than background amounts.
Low Results: No known health issues are related to low levels of phenylpropionate.

Phthalate

Phthalates are used in the manufacture of plastics to allow for flexibility and to soften resins. Not only that, but it is found in everything from makeup to detergents, shampoos to time-released pharmaceutical drugs.
High Results: This toxin is a well known endocrine disruptor as well as causing neurological and developmental disorders. It can interfere with tryptophan metabolism resulting in an increase in quinolinic acid, a pro-inflammatory and neurotoxic compound. Phthalates have also been implicated in abnormal fetal development, especially in male fetuses.
Low Results: While a low reading is desirable, it may indicate the inability to excrete this toxic component of many plastics.

P-Hydroxybenzoate

High Results: High levels of p-Hydroxybenzoate has been suggested to be a metabolite of bacterial action on tyrosine, it is more likely to be a metabolite of paraben exposure. Parabens are common additives to foods and cosmetics.
Low Results: While a low reading of this metabolite of parabens is desirable, it may indicate the inability to excrete this toxic component of many plastics.

P-Hydrozyphenlacetate

P-Hydroxyphenlacetate is a metabolite of a dysbiotic gut.
High Results: may be indicative of overgrowth of intestinal bacterial or protozoa especially Giardia lamblia, Clostridium difficile, Proteus vulgaris ileal resection with blind loop, and other small intestine infestations of anaerobic bacteria. Other possibilities are that these results are due to malabsorption of tyrosine due to HCL deficiency, overuse of antibiotics, or lactose intolerance.
Low Results: No known health issues are related to low levels of p-hydroxyphenylacetate.

P-Hydroxyphenyllactate

P-Hydroxyphenyllactate is a metabolite of tyrosine and is involved in controlling cell-growth.
High Results: High levels of this organic acid are indicative of an ongoing pro-oxidative response. Increased tissue growth, oxidative challenges due to toxicity, inborn errors of metabolism and low levels of vitamin C may be reasons for high results.
Low Results: No known health issues are related to low levels of p-hydroxyphenyllactate.

Pyroglutamate

Pyroglutamate, part of the glutathione pathway, becomes elevated when the glutamic acid part of the glutathione tri-peptide is transformed into pyroglutamate instead of glutathione.

High Results: may be due to glutathione depletion due to small intestinal amino acid absorption and kidney amino acid recovery. There may be inadequate quantities of sulfur amino acids such as methionine or cysteine or inadequate intake and reserves of glycine.

Low Results: No known health issues are related to low levels of pyroglutamate.

Pyruvate

Pyruvate is the end product of glucose metabolism.

High Results: may be indicative of a fundamental deficiency of B-complex vitamins and lipoic acid. High results are also seen in anorexia and other undereating disorders.

Low Results: No known health issues are related to low levels of pyruvate.

Quinolinate

Part of tryptophan metabolism that may not be operating properly when seen in anything more than background levels.

High Results: indicative of oxidative stress that may be favorably resolved by the use of a broad spectrum of antioxidants. It is also a marker for deranged tryptophan metabolism and is an antagonist of the NMDA receptors leading to a decreased seizure threshold in epileptics. It is also found often in ongoing bacterial, fungal, viral and parasitic infections.

If the markers for phthalates are also elevated, it is important to avoid the plasticizer in your environment and undergo a detoxification program as phthalates have been implicated in increased quinolinic acid.

Low Results: No known health issues are related to low levels of quinolinate.

Suberate

A byproduct in the oxidation of fatty acids and a marker for carnitine deficiency.

High Results: Elevated levels have been correlated to deficiencies of carnitine due to the inability to properly bring long chain fatty acids into the mitochondria. A deficiency of B2 (riboflavin) may also be found with elevations of the urinary organic acid.

Low Results: No known health issues are related to low levels of suberate.

Succinate

Part of the citric acid cycle that is highly dependent on coenzyme Q10 to create energy.

High Results: may be indicative of poor amino acid metabolism and could indicate a need for additional magnesium, riboflavin and Coenzyme Q10. It is also suggestive of mitochondrial dysfunction leading to symptoms of fatigue and possibly myocardial and/or neurological degeneration.

Low Results: may be indicative of a need for BCAA's (Branched Chain Amino Acids), especially leucine and isoleucine.

Sulfate

Sulfate is the by- product of sulfur metabolism primarily derived from amino acids.
High Results: may be indicative of a number of problems related to glutathione use and depletion. If urinary pyroglutamate and α-hydroxybutyrate are also elevated, this indicates an early stage of glutathione depletion as is suggests that the system is increasing the flow of sulfur compounds into the liver to meet a growing need for the antioxidant tri-peptide. If those two markers are not elevated, suspect a high intake of sulfur bearing foods or amino acids such as NAC (N-Acetyl-Cysteine), methionine or taurine.
Low Results: may indicate that Phase II liver detoxification may be impaired. If pyroglutamate and α-hydroxybutyrate are also elevated, this indicates a late stage of glutathione depletion.

t,t-Muconic Acid

trans,trans muconic acid is a marker for benzene exposure, a component of crude and refined petroleum. Exposure can come from many sources including oil refineries, petroleum plants, tire manufacturers, paint and shoe producing plants, gas stations, cigarette smoke inhalation, and high traffic areas.
High Results: Benzene has been shown to be carcinogenic and genotoxic as well as depressing red blood cells and hemoglobin. It has also been implicated in bone marrow depression as well as affecting the central nervous system.
Low Results: While low levels may be desirable, it may indicate the inability to excrete this toxic solvent.

Tartarate

Along with citramalate, tartarate may be a marker for the presence of yeast but also the ingestion of foods high in tartaric acid.
High Results: Elevated levels have often been associated with elevated yeast infestation but the data does not support that assumption. It is more likely that elevated levels of tartaric acid are found because of dietary sources such as grapes and grape by-products such as wine and juice. Research has also suggested that tartarate may be and antagonist to yeast which may be why elevated levels are seen in people with fungal infections.
Low Results: No known health issues are related to low levels of tartaric acid.

Tricarballylate

Produced by pathogenic bacteria, tribarballylate is a known binder of both magnesium and zinc.
High Results: may be due to an overgrowth of intestinal bacteria. This organic acid binds very tightly to magnesium, possibly zinc and calcium and may induce a deficiency in these important minerals. The bacterium that produces this element is also very fast growing and may cause numerous vitamin and

mineral deficiencies. As it may interfere with carbohydrate absorption, a diet low in carbohydrates is suggested.

Low Results: No known health issues are related to low levels of tricarballylate.

Vanilmandelate

Part of the catecholamine pathway, vanilmandelate can signify low available levels of phenylalanine or exposure to toxins such as heavy metals or petrochemical solvents.

High Results: seen with chronic stress, increased catecholamine synthesis, elevated caffeine ingestion, as well as the use of ephedra, and pseudoephedrine found in decongestants. High levels of this organic acid should be correlated with homovanillic acid (HVA) for potential abnormal cell growth.

Low Results: may be related to low CNS levels of epinephrine and norepinephrine. Clinical signs include depression, sleep disturbances, and the inability to handle stress and fatigue.

Xanthurenate

A by-product of the breakdown of the amino acid tryptophan

High Results: are consistent with a vitamin B6 deficiency.

Low Results: No known health issues are related to low levels of xanthurenate.

For inquiries on testing services and reports contact:

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