AUTISM RECOVERY 101

How To Interpret The Organic Acids Test (OAT) From Great Plains Laboratory

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Lecture Overview

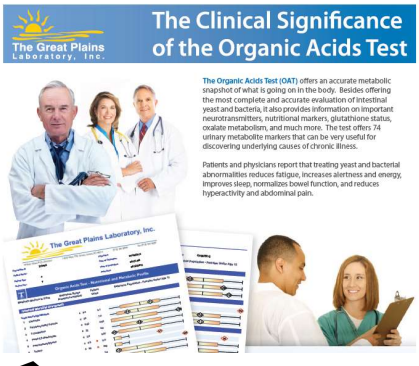
- Organic Acids Testing (OAT)
- The role of the OAT in candida assessment
- The role of the OAT in clostridia assessment
- The role of the OAT in oxalate assessment
- Certain neurotransmitter imbalances
- Indicators of other problems – *vitamin deficiencies, fatty acid oxidation, etc*.
- Mitochondrial dysfunction assessment

Prioritization Based On Common Findings

- The OAT is a complicated test with many markers indicating a variety of *potential* problems.
- Not all markers on any given OAT indicate problems that demand immediate attention.
- The goal is to get proficient at reading the OAT with regards to your child's particular situation.

Support Documents for Module #3

- The Clinical Significance of the Organic Acids Test *(marker interpretation handout) - pdf*
- Sample OAT *(pdf)*
- OAT – Quick Assessment Guide of the Most Commonly Seen Markers in Autism *(pdf)*
- Mitochondrial Lab Assessment at a Glance *(pdf)*
- Mitochondrial Cocktail Options *(pdf)*
- Lecture slides *(pdf)*
- Lecture slides – *note taking (pdf)*



Organic Acids Test (OAT) - *Quick Assessment Guide of the Most Commonly Seen Markers in Autism*

(The percentages and trends listed are approximations recognized by Dr. Woeller over many years in clinical practice evaluating the OAT.)

Page 1 of the OAT – *Yeast/Fungal Section*

1. Look at the Arabinose marker first. This will be the most common marker indicating the presence of candida. It is present in approximately 90% of OATs. Second to that is Tartaric Acid which can be seen with candida too. It tends to show up about 10 to 15% of the time. The level of Arabinose can be deceiving in some clinical situations. A high level doesn't always mean that a patient presents more symptomatically with yeast, or that a low level means a person is less affected. However, approximately 85 to 90% of the time the number matches up with a person's symptoms. Either way, any elevation suggests some invasiveness of candida and warrants some treatment.
2. Next evaluate the clostridia markers, i.e. HPHPA, 4-cresol. In the autism population these show up elevated approximately 60 to 70% of the time. The HPHPA is the most common marker for clostridia and appears elevated approximately 75% more frequently than 4-cresol. Both markers indicate

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Page 1 – *Yeast & Fungal Markers*

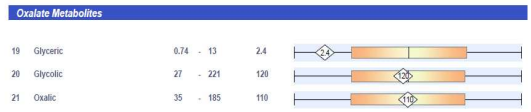
Organic Acids Test - Nutritional and Metabolic Profile

	Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)		Patient	Reference Population - Males Under Age 13
Intestinal Microbial Overgrowth					
Yeast and Fungal Markers					
1	Citramalic	≤ 5.0		4.4	4.4
2	5-Hydroxymethyl-2-furoic	≤ 28		1.6	1.6
3	3-Oxoglutaric	≤ 0.46		0	0.00
4	Furan-2,5-dicarboxylic	≤ 18		2.2	2.2
5	Furancarbonylglycine	≤ 3.1		0.15	0.15
6	Tartaric	≤ 6.5		1.3	1.3
7	Arabinose	≤ 50	H	93	93
8	Carboxycitric	≤ 25	H	68	68
9	Tricarballylic	≤ 1.3		0.08	0.08

Page 1 – *Bacterial and Clostridia Markers*

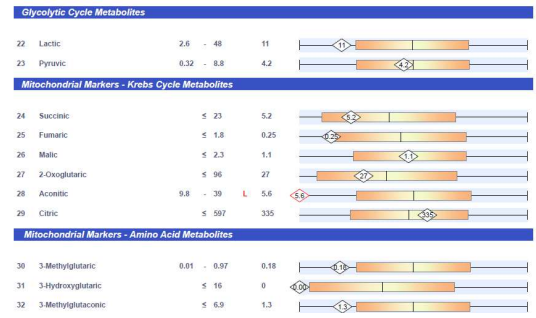
Bacterial Markers					
10	Hippuric	≤ 680		60	60
11	2-Hydroxyphenylacetic	≤ 0.86		0.37	0.37
12	4-Hydroxybenzoic	≤ 3.0		0.98	0.98
13	4-Hydroxyhippuric	≤ 30		12	12
14	DHPPA (Beneficial Bacteria)	≤ 0.59		0.04	0.04
Clostridia Bacterial Markers					
15	4-Hydroxyphenylacetic (*C. difficile, C. stricklandi, C. lituseburense & others*)	2.0 - 32		9.2	9.2
16	HPHPA (*C. sporogenes, C. caloritolerans, C. botulinum & others*)	≤ 220		206	206
17	4-Cresol (*C. difficile*)	≤ 84		57	57
18	3-Indoleacetic (*C. stricklandi, C. lituseburense, C. subterminale & others*)	0.60 - 14		2.0	2.0

Page 2 – *Oxalate Metabolites*



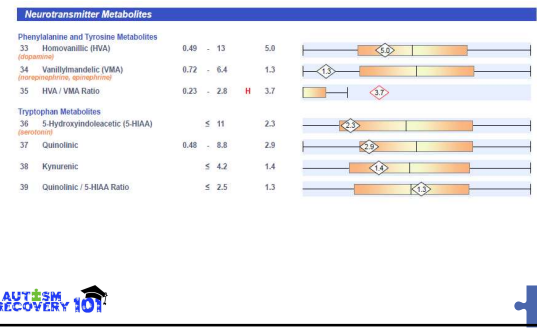
	Oxalate Metabolites				
19	Glyceric	0.74	- 13	2.4	
20	Glycolic	27	- 221	120	
21	Oxalic	35	- 185	110	

Page 2 – *Mitochondrial and Glycolytic Metabolites*



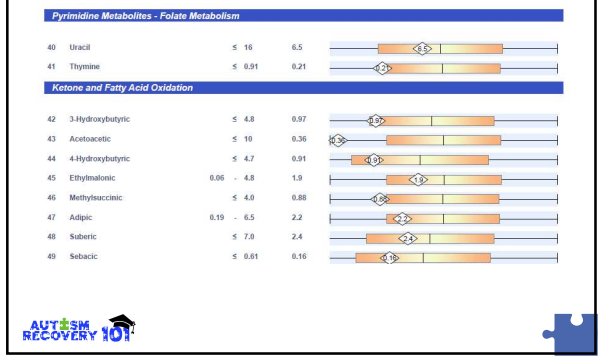
	Glycolytic Cycle Metabolites				
22	Lactic	2.6	- 48	11	
23	Pyruvic	0.32	- 8.8	4.2	
	Mitochondrial Markers - Krebs Cycle Metabolites				
24	Succinic	≤ 23		5.2	
25	Fumaric	≤ 1.8		0.25	
26	Malic	≤ 2.3		1.1	
27	2-Oxoglutaric	≤ 96		27	
28	Aconitic	9.8	- 39 L	5.6	
29	Citric	≤ 597		335	
	Mitochondrial Markers - Amino Acid Metabolites				
30	3-Methylglutaric	0.01	- 0.97	0.18	
31	3-Hydroxyglutaric	≤ 16		0	
32	3-Methylglutaconic	≤ 6.9		1.3	

Page 2 – *Neurotransmitter Metabolites*



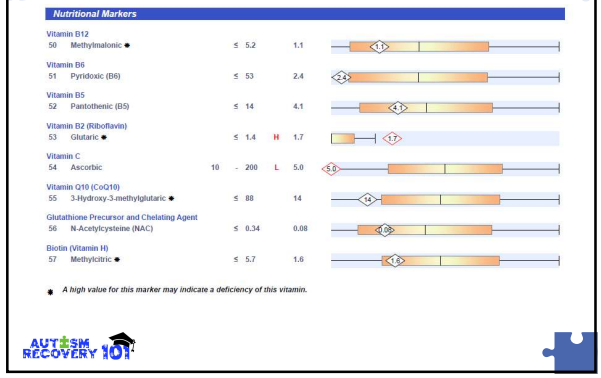
	Neurotransmitter Metabolites				
	Phenylalanine and Tyrosine Metabolites				
33	Homovanillic (HVA) (dopamine)	0.49	- 13	5.0	
34	Vanillylmandelic (VMA) (norepinephrine, epinephrine)	0.72	- 6.4	1.3	
35	HVA / VMA Ratio	0.23	- 2.8 H	3.7	
	Tryptophan Metabolites				
36	5-Hydroxyindoleacetic (5-HIAA) (serotonin)	≤ 11		2.3	
37	Quinolinic	0.48	- 8.8	2.9	
38	Kynurenic	≤ 4.2		1.4	
39	Quinolinic / 5-HIAA Ratio	≤ 2.5		1.3	

Page 3 – Pyrimidines and Fatty Acids



Pyrimidine Metabolites - Folate Metabolism					
40	Uracil	≤	16	6.5	
41	Thymine	≤	0.91	0.21	
Ketone and Fatty Acid Oxidation					
42	3-Hydroxybutyric	≤	4.8	0.97	
43	Acetoacetic	≤	10	0.36	
44	4-Hydroxybutyric	≤	4.7	0.91	
45	Ethylmalonic	0.06	- 4.8	1.9	
46	Methylsuccinic	≤	4.0	0.88	
47	Adipic	0.19	- 6.5	2.2	
48	Suberic	≤	7.0	2.4	
49	Sebacic	≤	0.61	0.16	

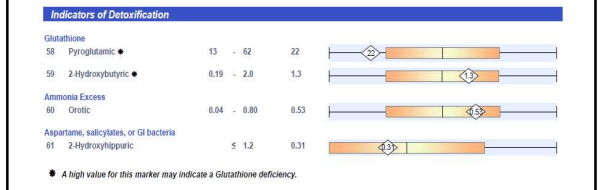
Page 3 – Nutritional Markers



Nutritional Markers						
Vitamin B12						
50	Methylmalonic ✹	≤	5.2		1.1	
Vitamin B6						
51	Pyridoxic (B6)	≤	53		2.4	
Vitamin B5						
52	Pantothenic (B5)	≤	14		4.1	
Vitamin B2 (Riboflavin)						
53	Glutaric ✹	≤	1.4	H	1.7	
Vitamin C						
54	Ascorbic	10	- 200	L	5.0	
Vitamin Q10 (CoQ10)						
55	3-Hydroxy-3-methylglutaric ✹	≤	88		14	
Glutathione Precursor and Chelating Agent						
56	N-Acetylcysteine (NAC)	≤	0.34		0.08	
Biotin (Vitamin H)						
57	Methylcitric ✹	≤	5.7		1.6	

✹ *A high value for this marker may indicate a deficiency of this vitamin.*

Page 4 – Indicators of Detoxification



Indicators of Detoxification					
Glutathione					
58	Pyroglutamic ✹	13	- 62		22
59	2-Hydroxybutyric ✹	0.19	- 2.0		1.3
Ammonia Excess					
60	Orotic	0.04	- 0.80		0.53
Aspartame, salicylates, or GI bacteria					
61	2-Hydroxyhippuric	≤	1.2		0.31

✹ *A high value for this marker may indicate a Glutathione deficiency.*

Page 4 – Amino Acid Metabolites and Mineral Metabolism

Amino Acid Metabolites

62	2-Hydroxyisovaleric	≤ 0.55	0	<0.02>
63	2-Oxoisovaleric	≤ 2.5	0	<0.02>
64	3-Methyl-2-oxovaleric	≤ 1.1	0	<0.02>
65	2-Hydroxyisocaproic	≤ 0.68	0.04	<0.04>
66	2-Oxoisocaproic	≤ 0.46	0.12	<0.12>
67	2-Oxo-4-methiolbutyric	≤ 0.33	0.01	<0.01>
68	Mandelic	≤ 0.30	0	<0.02>
69	Phenyllactic	≤ 0.19	0.02	<0.02>
70	Phenylpyruvic	≤ 4.0	0.07	<0.07>
71	Homogentisic	≤ 0.61	0.01	<0.01>
72	4-Hydroxyphenyllactic	0.05 - 1.1	0.26	<0.26>
73	N-Acetylaspartic	≤ 5.9	2.1	<2.1>
74	Malonic	≤ 18	12	<12>

Mineral Metabolism

75	Phosphoric	1 000 - 7 300	1 793	<1793>

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Indicator of Fluid Intake

77	*Creatinine	169	mg/dL

*The creatinine test is performed to adjust metabolic marker results for differences in fluid intake. Urinary creatinine has limited diagnostic value due to variability as a result of recent fluid intake. Samples are rejected if creatinine is below 20 mg/dL unless the client requests results knowing of our rejection criteria.

Explanation of Report Format

The reference ranges for organic acids were established using samples collected from typical individuals of all ages with no known physiological or psychological disorders. The ranges were determined by calculating the mean and standard deviation (SD) and are defined as ± 2SD of the mean. Reference ranges are age and gender specific, consisting of Male Adult (≥13 years), Female Adult (≥13 years), Male Child (<13 years), and Female Child (<13 years).

There are two types of graphical representations of patient values found in the new report format of both the standard Organic Acids Test and the Microbial Organic Acids Test.

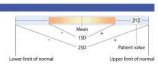
The first graph will occur when the value of the patient is within the reference (normal) range, defined as the mean plus or minus two standard deviations.

The second graph will occur when the value of the patient exceeds the upper limit of normal. In such cases, the graphical reference range is "shrunk" so that the degree of abnormality can be appreciated at a glance. In this case, the lower limits of normal are not shown, only the upper limit of normal is shown.

In both cases, the value of the patient is given to the left of the graph and is repeated on the graph inside a diamond. If the value is within the normal range, the diamond will be outlined in black. If the value is high or low, the diamond will be outlined in red.

Example of Value Within Reference Range

Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient Result	Reference Range - Males Age 13 and Under
Intestinal Microbial Overgrowth			
HPHPA (Clostridia marker)	< 219.3	212	212



Example of Elevated Value

Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient Result	Reference Range - Males Age 13 and Under
Intestinal Microbial Overgrowth			
HPHPA (Clostridia marker)	< 219.3	≥ 3884	3884

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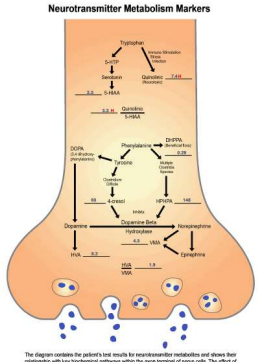
Neurotransmitter Metabolism Markers



The diagram contains the patient's test results for neurotransmitter metabolites and shows their relationship with key biochemical pathways within the axon terminal of nerve cells. The effect of microbial byproducts on the blockage of the conversion of dopamine to norepinephrine is also indicated.

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Requisition #: [redacted] Physician: KURT WOELLER DO

Patient Name: Date of Collection: 3/16/2015

Interpretation

High yeast/fungal metabolites (Markers 1,2,3,4,5,6,7,8) indicate a yeast/fungal overgrowth of the gastrointestinal tract. Prescription or natural (botanical) anti-fungals, along with supplementation of high potency multi-strain probiotics (20-50 billion cfu's), may reduce yeast/fungal levels.

HVA levels below the mean (Marker 33) may indicate lower production of the neurotransmitter dopamine, perhaps due to low dietary intake of the amino acid precursors phenylalanine or tyrosine. Homovanillic acid is a metabolite of the neurotransmitter dopamine. Supplementation with phenylalanine or tyrosine may be beneficial. Enzyme cofactors magnesium, B6 (pyridoxine) or biopterin may also be deficient; neurotransmitter levels may increase with supplementation with these cofactors if these are deficient.

VMA levels below the mean (Marker 34) may indicate lower production of the neurotransmitter norepinephrine or the hormone adrenaline, perhaps due to low dietary intake of the amino acid precursors phenylalanine or tyrosine. Vanylmandelic acid (VMA) is a metabolite of norepinephrine or adrenaline. Low VMA may also result from blocked conversion of dopamine to norepinephrine by *Clostridia* metabolites. Supplementation with phenylalanine or tyrosine may be beneficial. Enzyme cofactors magnesium, B6 (pyridoxine) or biopterin may also be deficient and respond to supplementation.

High HVA/VMA ratio (Marker 35) The most common reason for an elevation of the HVA/VMA ratio is the decreased conversion of dopamine to norepinephrine and epinephrine. The enzyme responsible for this conversion, dopamine betahydroxylase, is copper and vitamin C dependent, so an elevated ratio could be due to deficiencies of these cofactors. Another common factor is inhibition of this enzyme by *Clostridia* byproducts. A high HPHPA, 4-Cresol, or other elevations of metabolites would be consistent with the latter explanation.

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The Great Plains Laboratory, Inc.

William Shaw, Ph.D., Director 11813 West 77th Street, Lenexa, KS 66214 (913) 341-8949 Fax (913) 341-6207

Requisition #: Physician Name:

Patient Name: Date of Collection:

Patient Age: Time of Collection:

Sex: Print Date:

Organic Acids Test - Nutritional and Metabolic Profile

Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)		Patient Value	Reference Population - Females Under Age 13
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Yeast and Fungal Markers				
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4 Furan-2,5-dicarboxylic	≤ 22		1.6	1.6
5 Furancarbonylglycine	≤ 3.6		0.74	0.74
6 Tartaric	≤ 3.9		1.4	1.4
7 Arabinose	≤ 56	H	73	73
8 Carboxycitric	≤ 34		1.1	1.1

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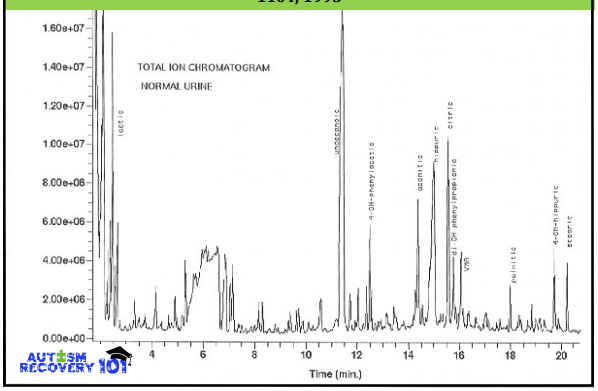
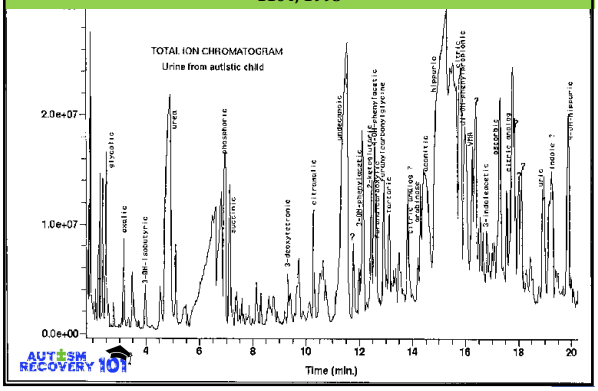
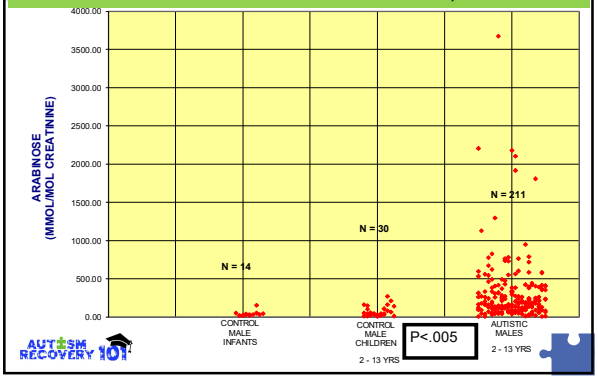
Shaw, W. Increased Urinary Excretion of Analogs of Krebs Cycle Metabolites and Arabinose in Two Brothers with Autistic Features. Clin Chem 41:1094-1104, 1995

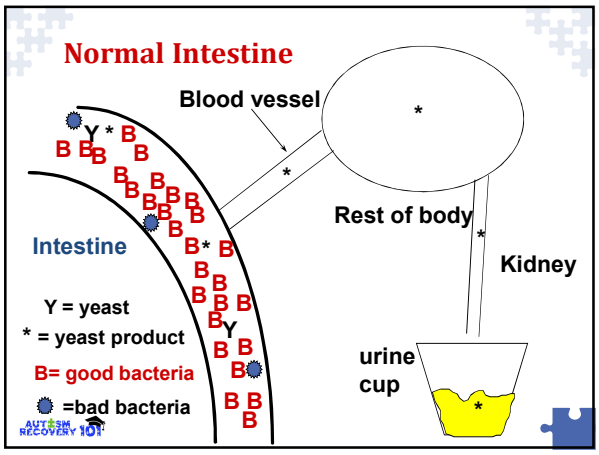


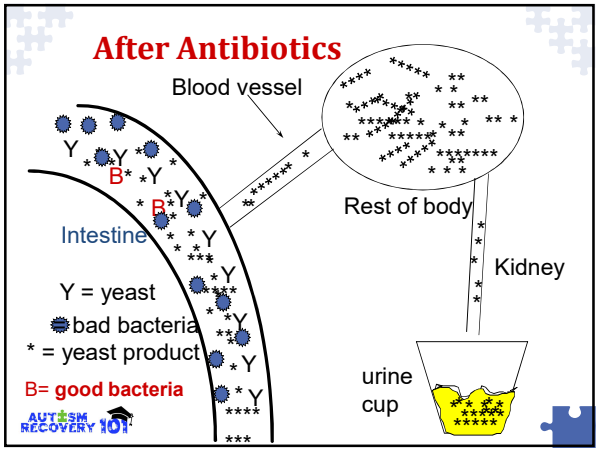
Shaw, W. Increased Urinary Excretion of Analogs of Krebs Cycle Metabolites and Arabinose in Two Brothers with Autistic Features. Clin Chem 41:1094-1104, 1995

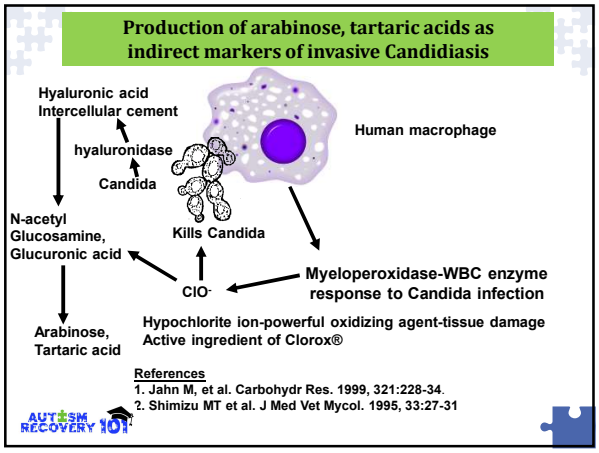


Shaw, W., et al Assessment of antifungal drug therapy in autism by measurement of suspected microbial metabolites in urine with GC/MS. Clinical Practice of Alternative Medicine: 15-26,2000.



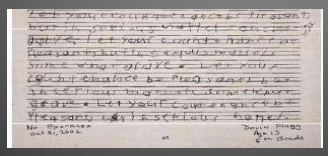

Normal Intestine
Blood vessel
Rest of body
Kidney
Intestine
Y = yeast
* = yeast product
B= good bacteria
=bad bacteria
urine cup


After Antibiotics
Blood vessel
Rest of body
Kidney
Intestine
Y = yeast
bad bacteria
* = yeast product
B= good bacteria
urine cup

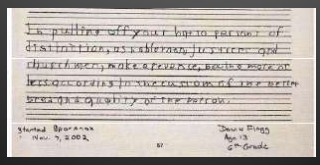

Production of arabinose, tartaric acids as indirect markers of invasive Candidiasis
Hyaluronic acid Intercellular cement
hyaluronidase
Candida
Human macrophage
Kills Candida
N-acetyl Glucosamine, Glucuronic acid
ClO-
Myeloperoxidase-WBC enzyme response to Candida infection
Arabinose, Tartaric acid
Hypochlorite ion-powerful oxidizing agent-tissue damage
Active ingredient of Clorox®
References
1. Jahn M, et al. Carbohydr Res. 1999, 321:228-34.
2. Shimizu MT et al. J Med Vet Mycol. 1995, 33:27-31

Handwriting improvement after antifungal therapy - *Discover Magazine*

Before Antifungal



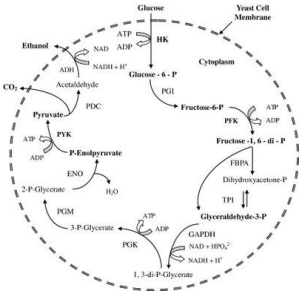
After Antifungal - 1 month later



List of *Observations* Seen in Autism That Appear (in part) Related to Candida Overgrowth

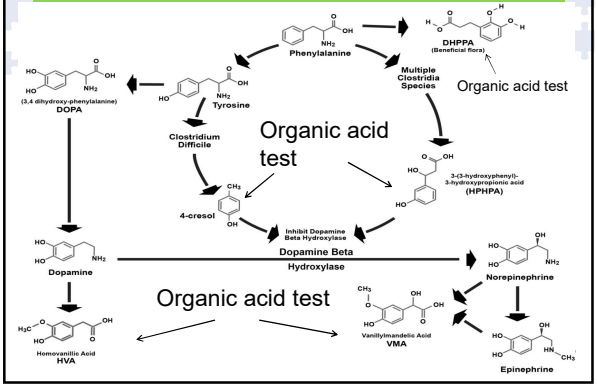
- **Silly/goofy/giddy, inappropriate laughter – *"acts drunk."***
- Sugar and carbohydrate cravings intensified.
- Heightened sensory seeking behavior, anxiety, and emotional instability.
- Strange behavior such as seeking pressure, hanging upside down, heightened seeking of masturbation.

Alcohol-related symptoms have been observed

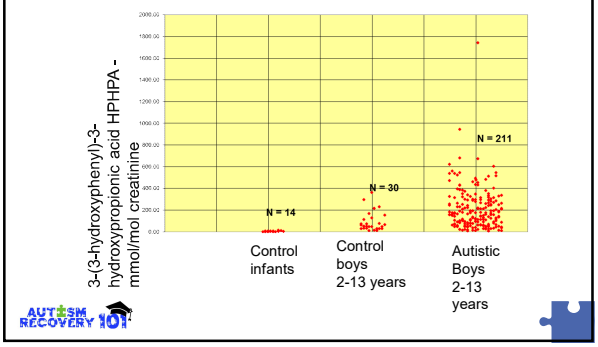


Plants, yeast and bacteria *– can ferment compounds (glucose) into acetylaldehyde and finally into alcohol.*

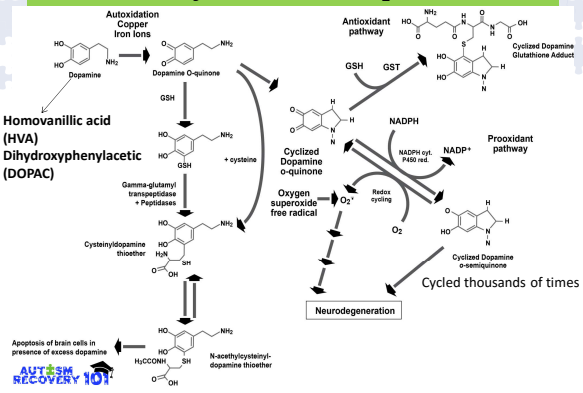
Critical effect of intestinal bacteria on certain brain and nervous system chemicals

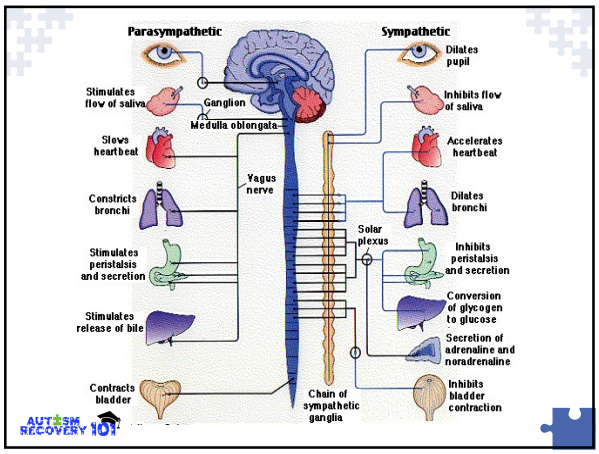


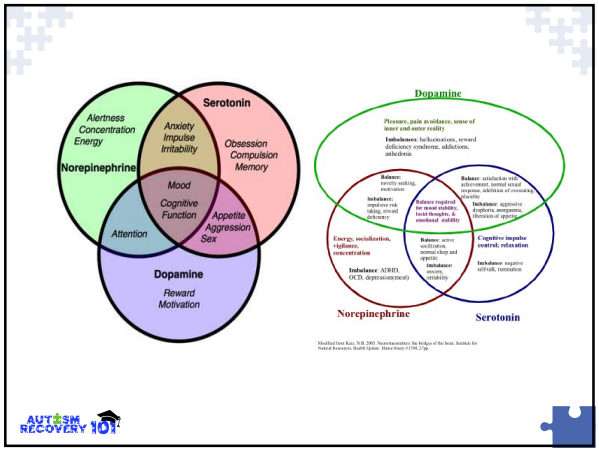
Distribution of values for HPHPA Clostridia metabolite in urine samples of male infants, control boys, and boys with autism.

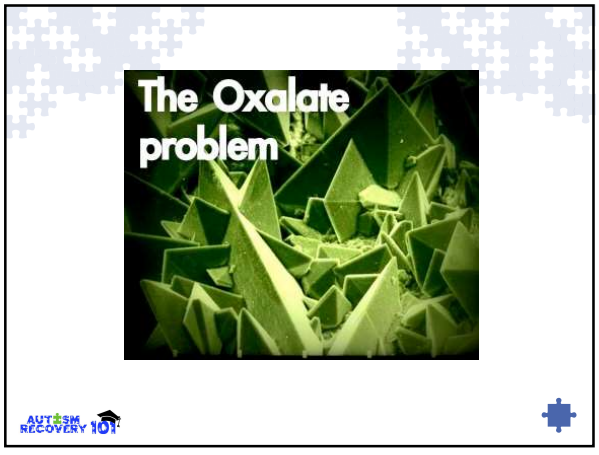


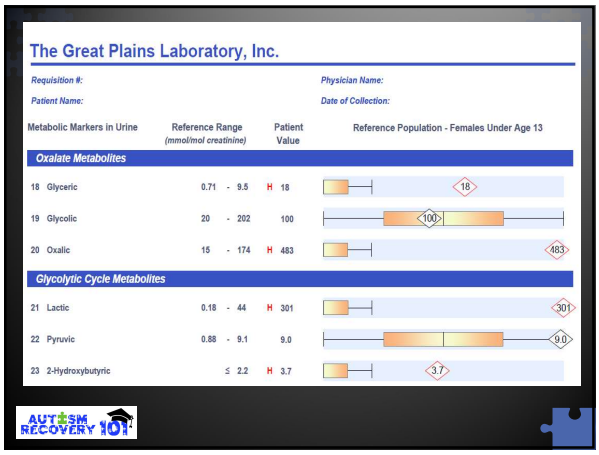
Toxicity of Excess Dopamine




Parasympathetic
Sympathetic
Stimulates flow of saliva
Ganglion
Medulla oblongata
Dilates pupil
Inhibits flow of saliva
Slows heartbeat
Accelerates heartbeat
Yagus nerve
Constricts bronchi
Dilates bronchi
Solar plexus
Stimulates peristalsis and secretion
Inhibits peristalsis and secretion
Conversion of glycogen to glucose
Stimulates release of bile
Secretion of adrenaline and noradrenaline
Contracts bladder
Chain of sympathetic ganglia
Inhibits bladder contraction


Alertness
Concentration
Energy
Norepinephrine
Serotonin
Anxiety
Impulse
Irritability
Obsession
Compulsion
Memory
Mood
Cognitive Function
Appetite
Aggression
Sex
Attention
Dopamine
Reward
Motivation
Dopamine
Norepinephrine
Serotonin

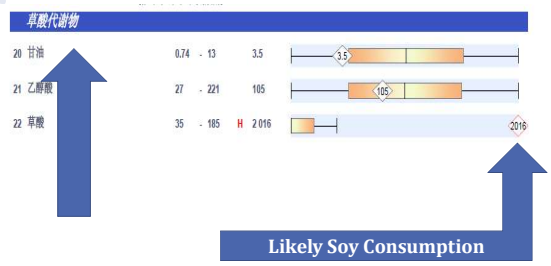

The Oxalate problem

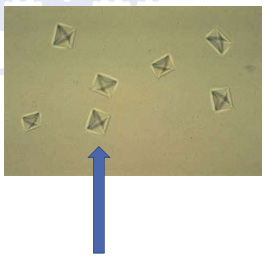


What Are Oxalates?

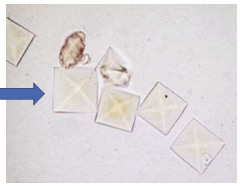
- Oxalate, and its acid form, are organic acids found from 3 primary sources:
  - *Diet*
  - *Fungus, such as mold and candida*
  - *Cell metabolism*
- Oxalic acid is the most acidic organic acid in body fluids.
- Ethylene glycol (antifreeze) - *primary toxicity effects are from oxalate crystal formation*.

Some Oxalate Levels Take Higher Priority Over Others

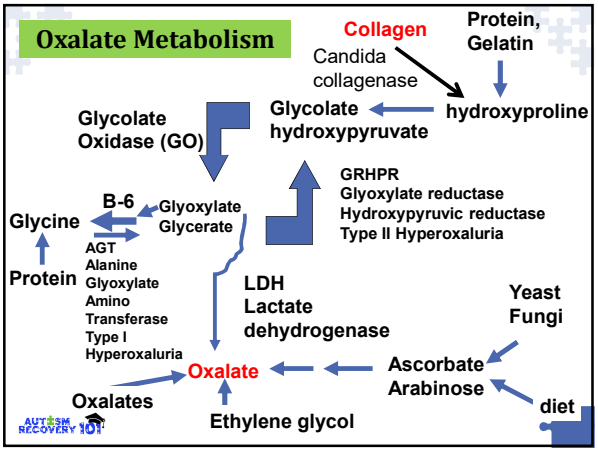




'X' Mark



Oxalate Metabolism

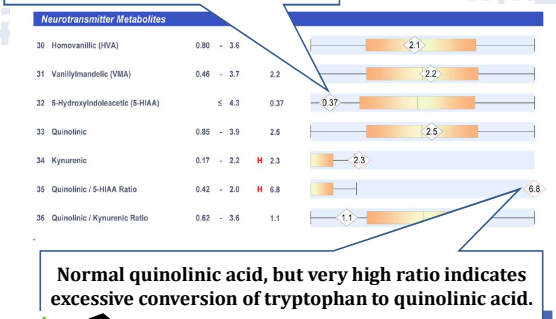


Common Complaints and Observations

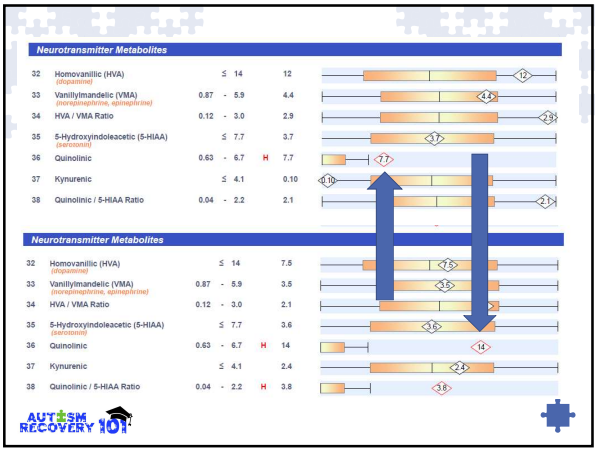
- Sandy and grainy stools
- Bladder irritability
- **Pain on urination – *holding penis or groin region***
- **Eye pain (eye poking in children)**
- Body aches, burning feeling in muscles
- **Moodiness, irritability, and aggressive behavior – *often seen in autism.***
- **Generalized pain that likely manifests as aberrant behavior.**

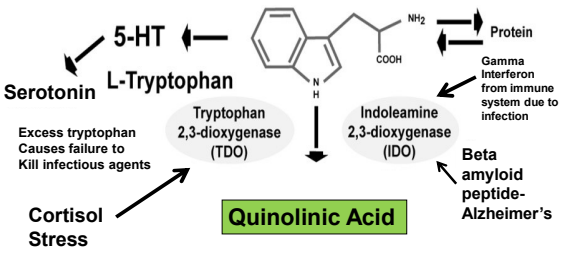
Brain and Nervous System Chemical Imbalances

Low normal tryptophan metabolite 5-HIAA



Normal quinolinic acid, but very high ratio indicates excessive conversion of tryptophan to quinolinic acid.

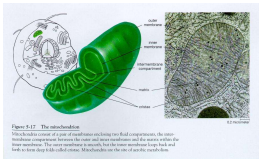


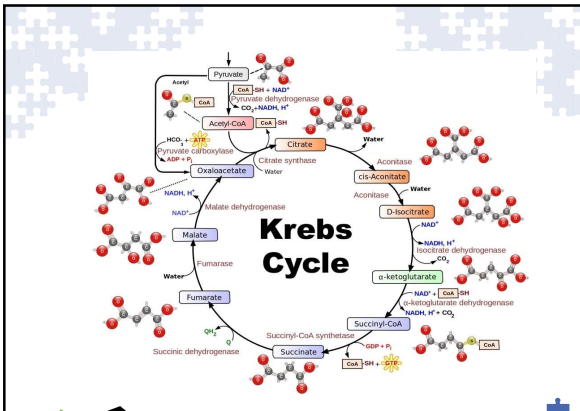


Kills cells containing bacteria, viruses, parasites. May also damage infectious organisms themselves. IDO causes drastic reduction in tryptophan for protein synthesis needed by infected cells and infectious organisms - *tryptophan at very low levels*.

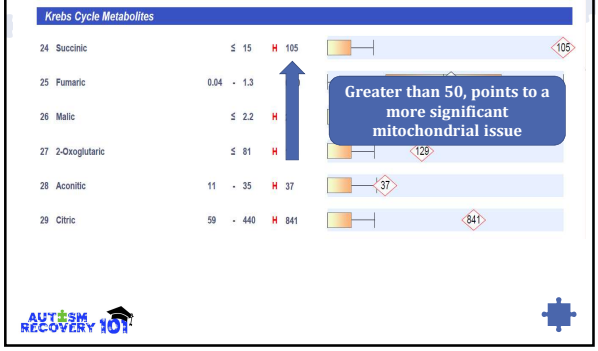
Mitochondria Dysfunction

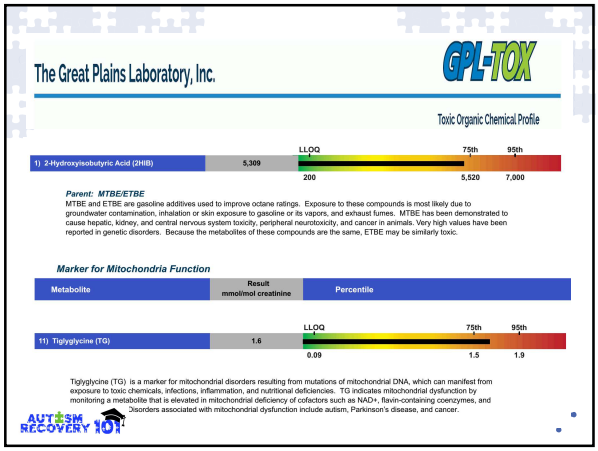
The Role of Mitochondrial Problems in Autism and the Association with Various Co-Morbid Conditions

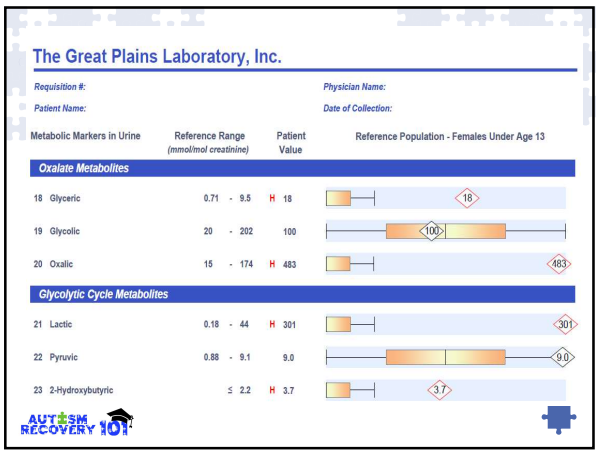




Krebs Cycle Metabolites







Mitochondrial Disease (Mde)

- Once thought to be rare, are now considered to be one of the most common metabolic problems in children.
- Some cases of Mde can occur in autism – *usually brought on by genetic mutations or abnormalities in the metabolic mechanism of mitochondrial function.*

Various Serious Health Problems

- **Heart defects** - *including electrical and contraction problems.*
- **Brain abnormalities** - *seizures, strokes*
- **Balance and coordination problems** - *including limb weakness and poor musculoskeletal development.*
- **Severe gastrointestinal problems** – *obstruction*

Autism = Mds (dysfunction - ***usually***)

In Autism, the majority of kids have a mitochondrial dysfunction (Mds) which indicates suboptimal functioning of mitochondria, but not definable as a specific mitochondrial disease (Mde).

Autism-Spectrum Children Can Have Similar Issues Related to Mito. Diseases

One study looking at over 20 autism-spectrum (ASD) kids showed no evidence of mitochondrial disease patterns via muscle biopsy testing, despite these kids having the following:

- *Attention, language, and behavior issues*
- *Seizures*
- *Poor muscle tone*
- *Gastrointestinal motility problems*

Mitochondrial Dysfunction in Autism

Mds versus Mde seems more common in autism as the majority of ASD kids overall presentation is *less severe* than kids with "classic" Mde.

Research and clinical speculation that many of the problems with Mds in Autism is environmentally induced.

1. Environmental chemicals, i.e. PCB, pesticides
2. Heavy metal toxicity, i.e. lead, nickel, cadmium, mercury.
3. Vaccine reactions
4. Cell membrane dysfunction from poor methylation, i.e. leads to increased oxidative stress via glutathione depletion.
5. Nutritional imbalances leading to susceptibility for poor cellular function.
6. Endogenous toxins from gut pathogens, i.e. clostridia (*propionic acid*).

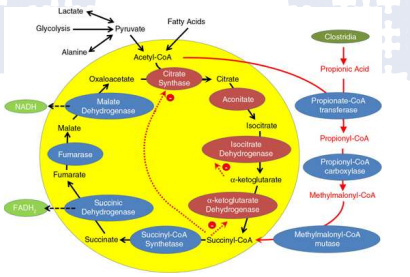


Fig. 2. The tricarboxylic acid cycle during high levels of propionic acid. Propionic acid, presumably derived from *Clostridia* spp., is metabolized to propionyl-CoA using acetyl-CoA. Propionyl-CoA is further metabolized into methylmalonyl-CoA, which enters the tricarboxylic acid cycle as succinyl-CoA. Succinyl-CoA inhibits the first and fourth enzyme in the tricarboxylic acid cycle. In this manner, propionic acid may 'short circuit' the tricarboxylic acid cycle, thereby reducing the production of nicotinamide adenine dinucleotide (NADH). This decrease in NADH is hypothesized to cause the decrease in complex I activity measured in the patients with consistent elevations in short and long acyl-carnitines (CESLAC)

Gastrointestinal dysfunction in autism spectrum disorders: the role of the mitochondria and the enteric microbiome (2015).

Biomarkers For Mitochondrial Problems

Mitochondrial diseases are often associated with abnormal laboratory markers, including:

- *Elevated lactic acid, ammonia, pyruvate, creatine kinase, and AST (aspartate aminotransferase).*
- *Low carnitine*

Many of these are also found in autism as well in association with mitochondrial dysfunction (Mds).

Mitochondrial Lab Assessment at a Glance

The Organic Acids Test (OAT) is an excellent first-line test for mitochondrial function for the autism population. The various markers listed on this test are highly specific to different levels of biochemistry involved in cellular metabolism.

Even though a large number of children with an autism-spectrum disorder manifest with imbalances in the mitochondrial sections of the OAT, many of these imbalances occur because of other complicating factors. The most common causes of mitochondrial imbalances come from endogenous toxins produced by yeast and bacteria. Oxalates also create stress in the mitochondrial along with various nutritional imbalances. Therefore, as a priority it is always important to address these issues first with a healthy diet and removal of offending foods (i.e. gluten, casein).

The foundational supplements such as a multivitamin/mineral that include vitamin C, E, and, various B-vitamins, along with calcium and magnesium are all important for supporting cellular metabolism. You will often your child can achieve improvement in overall mitochondrial function through basic nutrient support. A follow test with the OAT will often show positive changes without the need for further testing or intervention. However, there are circumstances where additional nutritional supplementation is worthwhile and diagnostic testing

Mitochondrial Dysfunction in Autism – *Supplement Therapy*

Supplement support and antioxidant therapy can be helpful for mitochondrial issues.

Examples:

- **L-Carnitine** – helps with fatty acid transport
- **Thiamine (B1), Pyroxidine (B6), Riboflavin (B2)** - *all support mitochondrial function.*
- **Antioxidants** – *help to decrease oxidative stress*
- **'Mitochondrial Cocktail'** – *combination approach for balanced mitochondrial support.*

Mitochondrial Cocktail Options

In many situations you will be supporting mitochondrial function already through the foundational nutritional products, i.e. multivitamins and multi-minerals that contain vitamin E, C_q and B-vitamins. However, there are certain supplements that have added benefit for cellular metabolism and can be useful to add to a supplement program.

See the handout document titled "Mitochondrial Lab Assessment at a Glance" for specifics on laboratory markers indicating problems in the mitochondria.

Clinical indicators that may suggest an underlying mitochondrial problem:

- *Poor physical energy and stamina*
- *Poor immunity*
- *Seizure disorder*
- *Low muscle tone and strength*
- *Poor gross and/or fine motor skills*
- *Cyclical vomiting*
- *Ongoing digestive problems not resolved by eradicating pathogens, dietary changes, and confirmation of no inflammation.*

Common Mitochondrial Support Supplements:

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Mitochondrial 'Cocktail' Example

Example is for a 18 Kg (40lbs) child

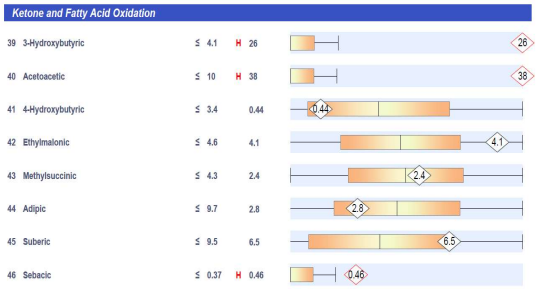
- **L-Carnitine** – *40 to 50mg/kg per day (approx. 1000mg per day).*
- **(Ubiquinol – *active CoQ10*)** – *5 to 10 mg/kg (approx. 100mg to 200mg).*
- **NADH** – *5 mg+ daily*
- **Malic Acid** – *500mg to 1000mg daily*

NOTE: usually no more than 2000mg of L-carnitine or 400mg of CoQ10 are used daily for individuals with adult weights.

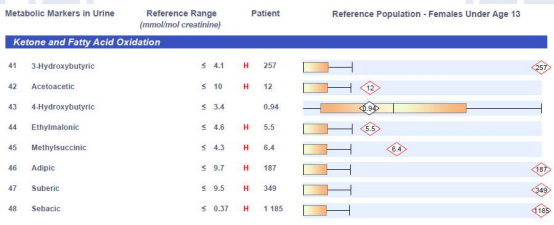
See handout "Mitochondrial Cocktail Options" for dosing recommendations

www.nbnus.com

Ketones and Fatty Acid Metabolism



2 year old girl from China



High dose Medium Chain Triglycerides (MCT Oil)

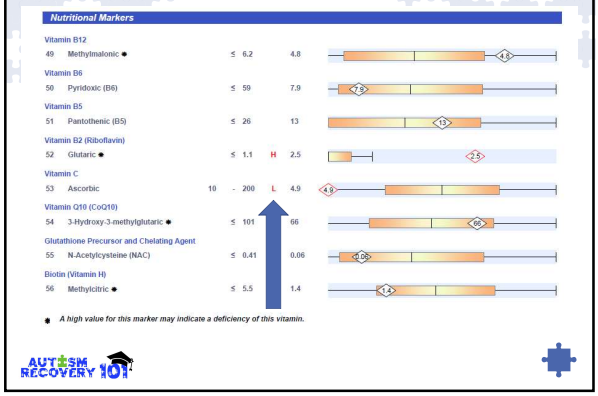
Vitamin Indicators

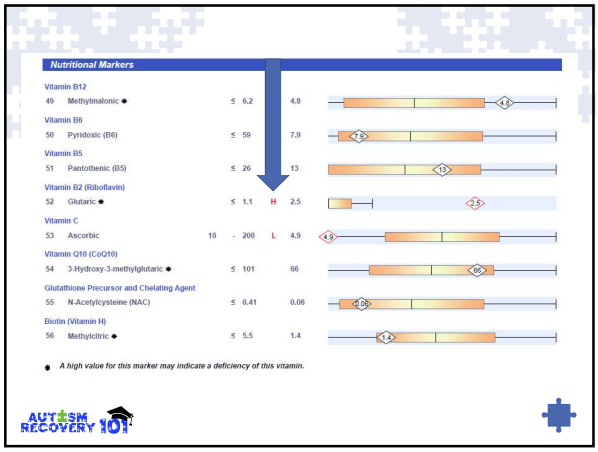
Indirect:

- Methylmalonic acid - *vitamin B-12*
- Methylcitric acid - *biotin*
- Glutaric and Succinic acid - *indicators of riboflavin and coenzyme Q-10 deficiency.*

Direct:

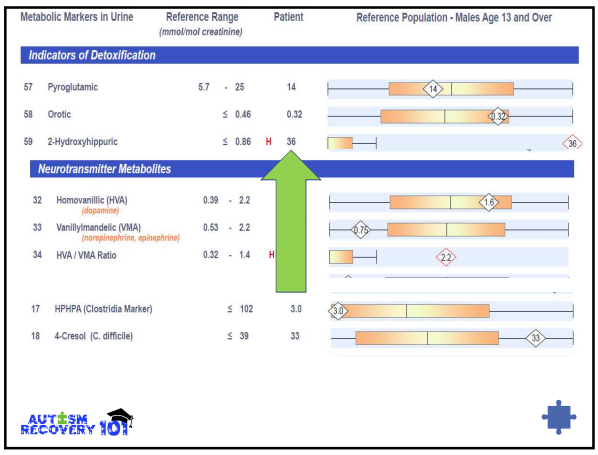
- Ascorbic acid - *vitamin C*
- Pantothenic acid - *B vitamin*
- Pyridoxic acid - *metabolite of vitamin B-6*

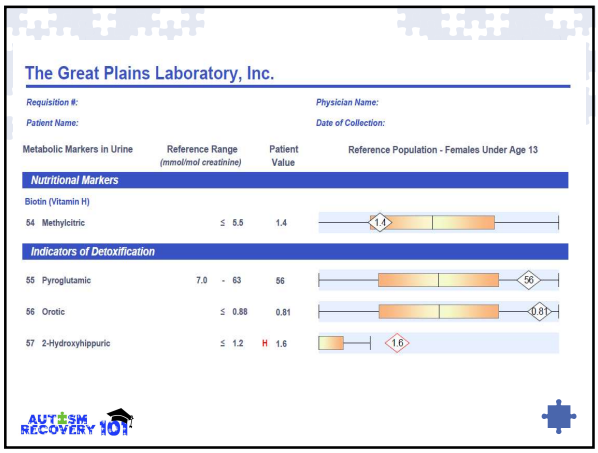


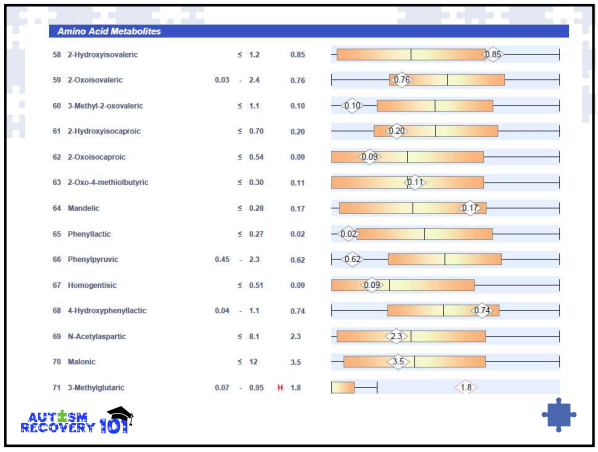


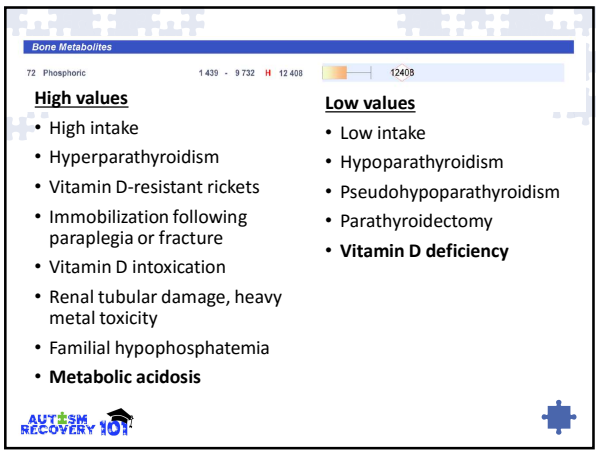
Most Common Nutritional Marker Imbalances

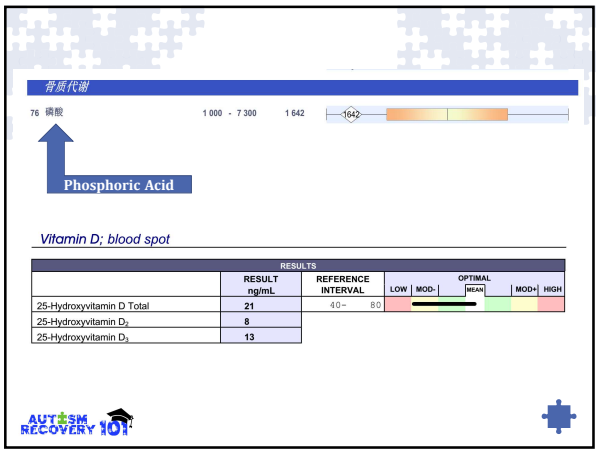
1. Low vitamin C (ascorbic acid)
2. Low or low normal vitamin B6 (pyridoxic acid)
3. High glutaric acid (vitamin B2)
4. High B5 (pantothenic acid)
5. Low to low normal N-acetyl-cysteine (NAC)
6. High CoQ10 marker
7. High B12 (methylmalonic acid) + High Methylcitric (biotin) – *rarely seen*




The Great Plains Laboratory, Inc.
Requisition #:
Physician Name:
Patient Name:
Date of Collection:
Metabolic Markers in Urine
Reference Range (mmol/mol creatinine)
Patient Value
Reference Population - Females Under Age 13
Nutritional Markers
Biotin (Vitamin H)
54 Methylcitric ≤ 5.5 1.4
Indicators of Detoxification
55 Pyroglutamic 7.0 - 63 56
56 Orotic ≤ 0.88 0.81
57 2-Hydroxyhippuric ≤ 1.2 H 1.6
AUTISM RECOVERY 101


Amino Acid Metabolites
58 2-Hydroxyisovaleric ≤ 1.2 0.85
59 2-Oxoisovaleric 0.03 - 2.4 0.76
60 3-Methyl-2-oxovaleric ≤ 1.1 0.10
61 2-Hydroxyisocaproic ≤ 0.70 0.20
62 2-Oxoisocaproic ≤ 0.54 0.09
63 2-Oxo-4-methiolbutyric ≤ 0.30 0.11
64 Mandelic ≤ 0.28 0.17
65 Phenyllactic ≤ 0.27 0.02
66 Phenylpyruvic 0.45 - 2.3 0.62
67 Homogentisic ≤ 0.51 0.09
68 4-Hydroxyphenyllactic 0.04 - 1.1 0.74
69 N-Acetylaspartic ≤ 8.1 2.3
70 Malonic ≤ 12 3.5
71 3-Methylglutaric 0.07 - 0.95 H 1.8
AUTISM RECOVERY 101


Bone Metabolites
72 Phosphoric 1 439 - 9 732 H 12 408
12408
High values
• High intake
• Hyperparathyroidism
• Vitamin D-resistant rickets
• Immobilization following paraplegia or fracture
• Vitamin D intoxication
• Renal tubular damage, heavy metal toxicity
• Familial hypophosphatemia
• Metabolic acidosis
Low values
• Low intake
• Hypoparathyroidism
• Pseudohypoparathyroidism
• Parathyroidectomy
• Vitamin D deficiency
AUTISM RECOVERY 101



Prioritization of OAT Findings *(general recommendations)*

1. If any clostridia marker is high this takes priority regarding treatment.
2. If arabinose, or other yeast markers are high, need to correlate to clinical picture.
3. If oxalate is high need to correlate to clinical picture.

NOTE: remember, these 3 areas often greatly influence other markers on the OAT.

Prioritization of OAT Findings *(general recommendations)*

4. If one or more of the first 3 sections are positive *(yeast, clostridia, oxalate)* and other imbalances are seen then additional supplement therapy can be worthwhile:
   - *If one specific fatty acid marker is significantly high, or multiple are high using L-carnitine is worthwhile.*
   - *If multiple mitochondrial markers are high consider MitoSpectra or just L-Carnitine.*
   - *If HVA and/or HVA/VMA ratio are high cross check to clostridia markers.*

Prioritization of OAT Findings (general recommendations)

4. *(continued):*

- If 5-HIAA is low to low normal consider 50mg to 100mg of 5-HTP daily for serotonin support.
- If Quinolinic Acid is high use at least 500mg of Niacinamide as a priority supplement.
- If HVA and/or HVA/VMA ratio high cross check to clostridia markers.
- If Uracil is high consider additional L-Methyl-Folate supplementation, i.e. 500mcg to 1000mcg daily.
- Address vitamin deficiencies individually as needed
- Low phosphoric – *consider Vitamin D testing or supplementation with Vitamin D3, i.e. 1000IU/25lbs body weight (approximately).*

Module #4

Topic

- Treating Yeast, Bacteria and Other Digestive Problems*:*
  - *Success strategies for treating common pathogens*
  - *Remedies for other digestive problems*
  - *Review of behaviors often linked to digestive problems.*

Thank You

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