



25205-0019

* US BioTek US BioTek. 16020 Linden Av N, Shoreline WA 98133

Lab ID
Patient ID P000062
Ext ID 25205-0019

Test Patient
Sex: Male • 55yrs • 01-Jan-70

RECEIVED
24-Jul-25

NEUROTRANSMITTER PANEL

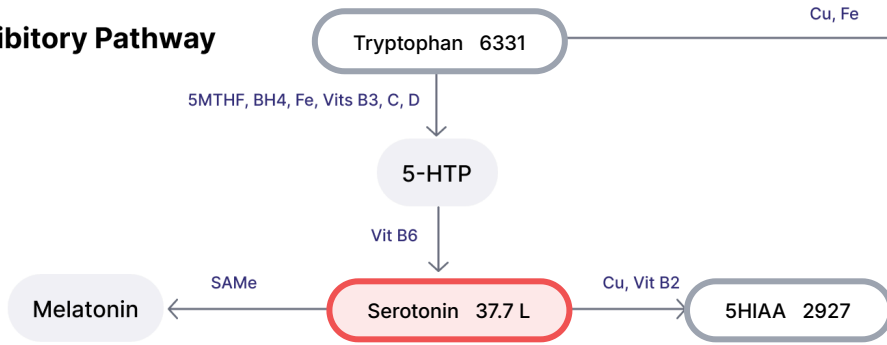
Specimen type - Urine, Spot

Collected

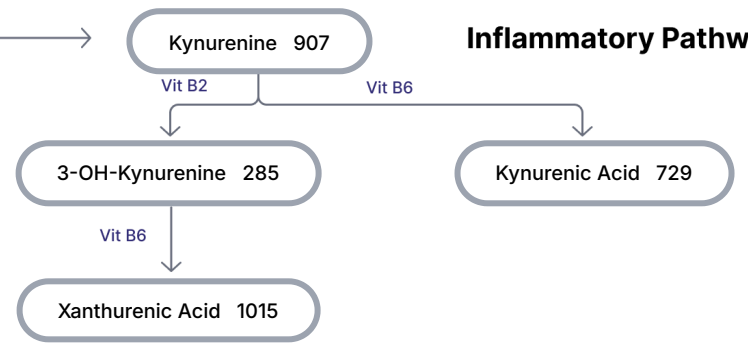
10-Jul-25

Legend Not Tested Within Range **Out of Range** L = Low, LL = Critically Low H = High, HH = Critically High Regulator Enzyme

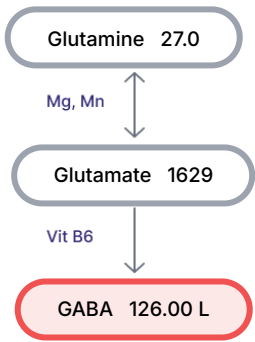
Inhibitory Pathway



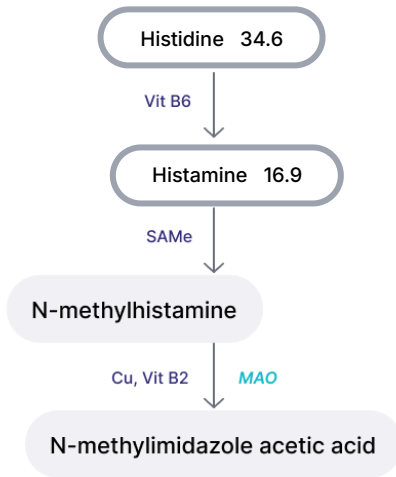
Inflammatory Pathway



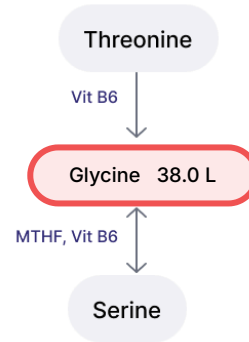
GABA, Glutamate



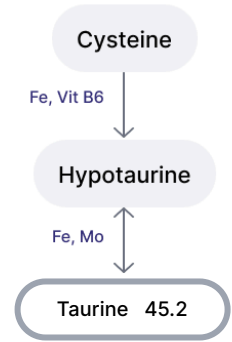
Histamine



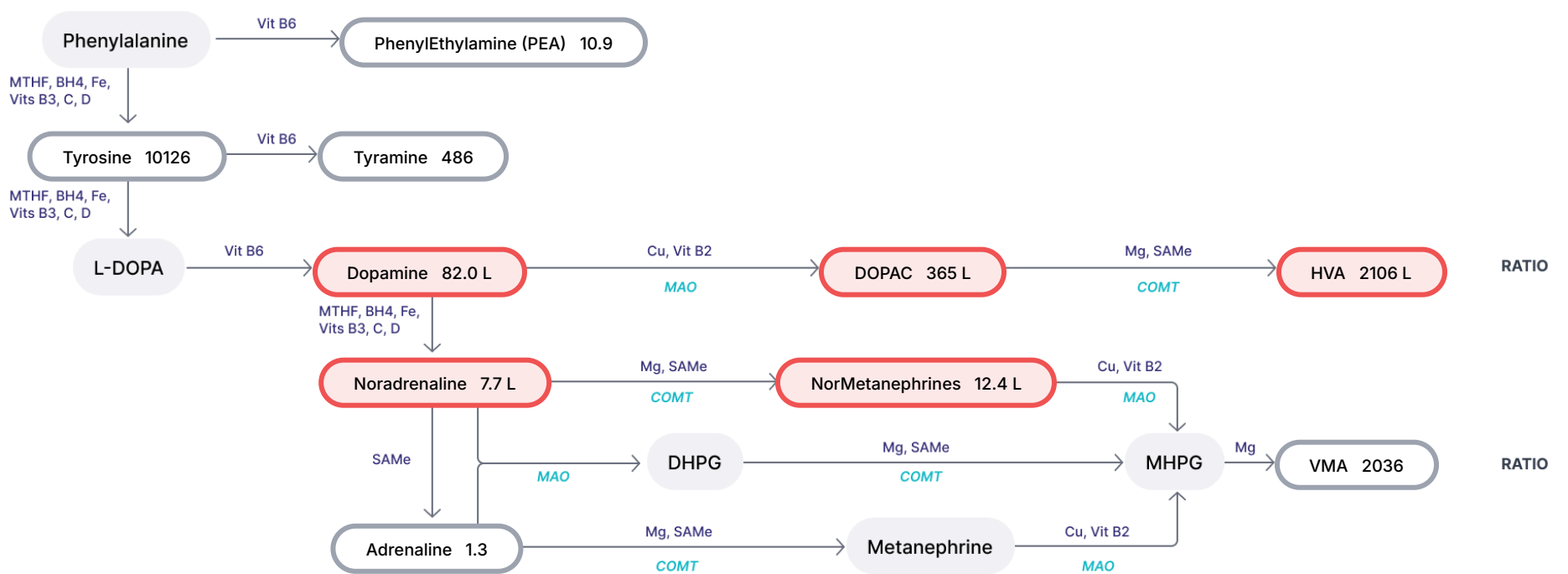
Glycine



Taurine



Excitatory Pathway





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INHIBITORY NEUROTRANSMITTERS

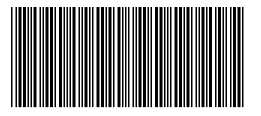
| TEST | RESULT | H/L | | REFERENCE | UNITS |
|------------|--------|-----|--|-----------------|--------|
| Tryptophan | 6331 | | | (2633-12688) | ug/gCR |
| Serotonin | 37.7 | L | | (47.6-140.3) | ug/gCR |
| 5HIAA | 2927 | | | (2205-11816) | ug/gCR |
| GABA | 126.00 | L | | (167.00-463.00) | ug/gCR |
| Glycine | 38.0 | L | | (41.0-295.0) | ug/gCR |
| Taurine | 45.2 | | | (7.1-293.0) | ug/gCR |

NEUROINFLAMMATORY MARKERS

| TEST | RESULT | H/L | | REFERENCE | UNITS |
|------------------|--------|-----|--|------------|--------|
| Kynurenine | 907 | | | (108-1641) | ug/gCR |
| Kynurenic Acid | 729 | | | (437-1719) | ug/gCR |
| 3-OH-Kynurenine | 285 | | | (80-822) | ug/gCR |
| Xanthurenic Acid | 1015 | | | (450-2175) | ug/gCR |

EXCITATORY NEUROTRANSMITTERS

| TEST | RESULT | H/L | | REFERENCE | UNITS |
|--------------------------------|--------|-----|--|---------------|--------|
| Glutamate | 1629 | | | (1213-4246) | ug/gCR |
| Glutamine | 27.0 | | | (27.0-106.0) | ug/gCR |
| Histidine | 34.6 | | | (10.8-98.9) | ug/gCR |
| Histamine | 16.9 | | | (3.6-44.3) | ug/gCR |
| N-methylHistamine | 90.0 | | | (59.0-195.0) | ug/gCR |
| PhenylEthylamine (PEA) | 10.9 | | | (3.6-38.8) | ug/gCR |
| Tyrosine | 10126 | | | (3128-15548) | ug/gCR |
| Tyramine | 486 | | | (187-910) | ug/gCR |
| Dopamine | 82.0 | L | | (103.0-282.0) | ug/gCR |
| DOPAC | 365 | L | | (495-2456) | ug/gCR |
| HVA | 2106 | L | | (3025-9654) | ug/gCR |
| Noradrenaline | 7.7 | L | | (10.0-35.7) | ug/gCR |
| NorMetanephrines | 12.4 | L | | (13.4-44.8) | ug/gCR |
| Adrenaline | 1.3 | | | (0.8-6.2) | ug/gCR |
| VMA | 2036 | | | (1996-5939) | ug/gCR |
| Noradrenaline/Adrenaline Ratio | 5.9 | | | (2.9-25.2) | ug/gCR |
| Creatinine, Urine | 5.90 | | | (3.45-22.90) | mmol/L |



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OPTIMAL RANGES TABLE (Adult >11 yrs)

| Inhibitory Neurotransmitters | Target Reference Range | Units |
|------------------------------|------------------------|--------|
| Tryptophan | 3970 - 8450 | ug/gCR |
| Serotonin | 100 - 215 | ug/gCR |
| 5HIAA | 2988 - 5850 | ug/gCR |
| GABA | 400 - 600 | ug/gCR |
| Glycine | 61 - 159 | ug/gCR |
| Taurine | 24.5 - 134 | ug/gCR |

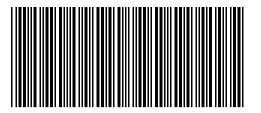
| Excitatory Neurotransmitters | Target Reference Range | Units |
|------------------------------|------------------------|--------|
| Glutamate | 2520 - 3700 | ug/gCR |
| Glutamine | 37 - 71 | ug/gCR |
| Histidine | 19.7 - 58.4 | ug/gCR |
| Histamine | 5.2 - 15.3 | ug/gCR |
| PhenylEthylAmine (PEA) | 5.3 - 16.1 | ug/gCR |
| Tyrosine | 4790 - 10278 | ug/gCR |
| Tyramine | 279 - 588 | ug/gCR |
| Dopamine | 200 - 330 | ug/gCR |
| DOPAC | 658 - 1449 | ug/gCR |
| HVA | 3737 - 7048 | ug/gCR |
| Noradrenalin | 18.5 - 25.5 | ug/gCR |
| Normetanephrine | - | - |
| VMA | 2580 - 4766 | ug/gCR |
| Adrenalin | 1.4 - 4.2 | ug/gCR |

| Neuroinflammatory Markers | Target Reference Range | Units |
|---------------------------|------------------------|--------|
| Kynurenine | 257 - 960 | ug/gCR |
| Kynurenic Acid | 639 - 1200 | ug/gCR |
| 3-Hydroxykynurenine | 147 - 467 | ug/gCR |
| Xanthurenic Acid | 694 - 1510 | ug/gCR |

There are multiple factors that play roles in neurotransmitter levels (Lifestyle, receptors, meds, supplements, diet, stress, etc).

The optimal reference ranges stated above have been determined/derived statistically from historical patient data.

Historically, these levels were achieved in the majority of patients as they experienced symptom relief or improvement.



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Inhibitory Neurotransmitters Comment

TRYPTOPHAN IS WITHIN THE REFERENCE RANGE:

Tryptophan originates from the diet and serves as a constituent of proteins and a precursor to neurotransmitters. A small fraction is used by the GI tract, with the remaining tryptophan pool distributed to peripheral circulation and transported to tissues such as the brain, heart, and skeletal muscle. Tryptophan not taken up by the upper GI tract is metabolized by resident microbiota. Tryptophan is a substrate for two biosynthetic pathways relevant to the neuropsychiatric interface: the generation of serotonin and thereafter melatonin, and the formation of kynurenine derivatives and thereafter niacin (vitamin B3).

SEROTONIN LEVELS LOW:

Generally regarded as the happiness molecule, serotonin has calming effects and contributes to the feelings of well-being. Serotonin elevates mood, decreases anxiety, appetite, and libido, improves sleep and memory, eases depression, and helps regulate body temperature. Most of serotonin in the human body is produced in the gastrointestinal tract, where it stimulates gut motility. Research shows that urinary serotonin levels are reduced in patients with depression (Nichkova et al., 2012), depleted neuron stores (poor nutrition with high demand), Interference from other signaling chemicals, Low carbohydrate diet, High protein competition, Heavy metal toxicity, Inflammation. Clinically, low serotonin is associated with anxiety, depression, changes in appetite, cravings, excessive worry, heightened sensitivity to pain, hot flashes, hunger, low mood, migraine, obsessive compulsive disorder, panic disorder, sleep disturbances, and worsened PMS symptoms.

TREATMENT:

When serotonin is low, supplementation with cofactors to promote biosynthesis (e.g. vitamin B6), precursors (tryptophan/5-HTP), theanine, SAME, Carnitine, St Johns Wort, SSRI, Massage, Melatonin, Hydroxy-tryptophan, Vit B6, Fish Oils, and probiotics may be helpful. Additionally, lifestyle modifications, such as regular exposure to bright light, healthy diet, sufficient exercise, and positive self-talk are all effective strategies that result in increased serotonin levels.

5-HIAA IS LOW NORMAL:

5-HIAA is the primary metabolite of serotonin via the actions of monoamine oxidase and aldehyde dehydrogenase enzymes. Research shows that urinary 5-HIAA levels are reduced in patients with anorexia nervosa, and MAO deficiency as well as individuals with low serotonin levels.

TREATMENT CONSIDERATIONS:

Increasing serotonin and it's precursors 5-HTP and tryptophan, and supporting the activity of the MAO enzyme with B2 and copper may be beneficial.

GABA LEVELS LOWER THAN THE REFERENCE RANGE.

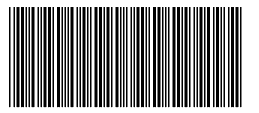
The brain's major inhibitory neurotransmitter GABA functions as the off switch in the brain. GABA is essential to limiting excitation so that input signals are balanced and not overdone. GABA prevents anxiety, improves mood, promotes sleep, lowers blood pressure, acts as a muscle relaxant, aids in formation and storage of fear memories, increases insulin secretion and decreases blood glucose levels. Clinically, low GABA levels are implicated in anxiety, depression, headaches, menopause symptoms, panic attacks, post-traumatic stress disorder, and sleep difficulties. Low GABA levels may also be associated with adrenal distress and HPA axis dysfunction, and disorders like attention deficit hyperactivity disorder and Tourette syndrome.

TREATMENT:

Supplementation with GABA, L-theanine, cofactor support (e.g. B6), growth hormone-releasing hormone, Ginko biloba, Ashwagandha, Kava, Valerian root, Melissa off (lemon balm), Scutellaria sinensis (skullcap), Gotu Cola, Magnolia and Phellodendron bark, and probiotics may be helpful. Caffeine has been found to inhibit GABA release, so avoidance may be beneficial. Additionally, yoga and meditation increase brain GABA levels.

GLYCINE IS LOWER THAN THE REFERENCE RANGE:

May be due to depression. Although research on urinary levels of glycine is scarce, levels of glycine in blood are lower in depressed individuals than in controls.



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Glycine is a neurotransmitter and a simple, nonessential amino acid that plays a role in the production of DNA, phospholipids, collagen, creatine, heme and glutathione. Glycine serves as an anti-inflammatory agent, calms aggression, improves sleep quality, stabilizes blood sugar, improves metabolic parameters and modulates excitatory signals in the brain. Low levels may be indicative of chronically increased demand for tetrahydrofolate (active folic acid) production, for which glycine serves as a precursor.

Additional research studies show that urinary glycine levels are reduced after intense exercise, and in patients with rheumatoid arthritis, or hypometabolic disorders, such as hypothyroidism, obesity, and diabetes.

THERAPEUTIC CONSIDERATIONS:

Glycine supplementation, vitamin B6, serine and MTHF may all support optimal glycine levels.

TAURINE IS WITHIN NORMAL RANGE:

Taurine is a semi-essential or conditionally essential sulfur-containing amino acid and an inhibitory (calming) neurotransmitter. Taurine improves sleep, relieves anxiety, alleviates fatigue, aids with metabolism and digestion, and promotes glucose control and electrolyte balance. The main source of taurine is diet. Taurine protects healthy cells and tissues, functions as a potent antioxidant to reduce oxidative stress, mitigates mitochondrial and endoplasmic reticulum stress, inhibits lipid peroxidation, improves energy metabolism, regulates gene expression, and participates in detoxification, calcium homeostasis and osmoregulation processes. By fulfilling all these functions, taurine is therefore protective in cardiovascular health, improves lean body mass and exercise performance. With regard to brain health, taurine serves a neuroprotective role, promotes neural development in embryonic and adult brain tissues, and is an important factor in neurogenesis.

Neuroinflammatory Neurotransmitter Comment

3-HYDROXY-KYNURENINE IS WITHIN THE REFERENCE RANGE:

3-Hydroxy Kynurenine (3-OH Kynurenine) is a metabolic intermediate of the kynurenine pathway, one of the major metabolites of tryptophan degradation. Kynurenine is transformed into 3-OH Kynurenine, which acts as a N-methyl-d-aspartate (NMDA) glutamate receptor agonist and has been demonstrated to exert neurotoxic effects, especially when in excess.

Excitatory Neurotransmitter Comment

GLUTAMINE IS LOW NORMAL:

Glutamine is an essential and should be the most abundant free amino acid in the human body.

Glutamine provides fuel for rapidly dividing cells (lymphocytes, enterocytes and intestinal epithelial cells), helps balance ammonia levels in the body, improves immune system function, contributes to biosynthesis of proteins, amino acids, nucleic acids and glutathione, and protects intestinal lining. Additionally, glutamine increases glutamate and GABA levels in the brain and in the body.

Although the body usually makes enough glutamine to meet all its needs, extreme stress (e.g., strenuous exercise, persistent stress, or injury) can increase the demand for glutamine beyond the amount naturally manufactured. Low circulating glutamine levels are reported after intense exercise, in overtraining syndrome, in diabetes, depression, and in autism spectrum disorder. Low glutamine levels are associated with high oxidative stress.

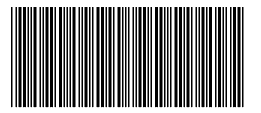
THERAPEUTIC CONSIDERATIONS:

Consider supplementation with glutamine which comes in capsules or powder. Glutamine is a fairly bland tasting amino acid and easily goes into smoothies. Glutamine is also high in chicken, fish, cabbage, spinach, dairy, tofu and lentils among many other foods.

GLUTAMATE LEVELS NORMAL:

The brain's major excitatory neurotransmitter glutamate (also known as glutamic acid) functions as the "on" switch in the brain. Glutamate regulates appetite, thinking (cognition), increases gut motility, optimizes learning, modulates memory, mood and perception of pain, improves libido, and decreases sleep. The brain is the major contributor of glutamate in the body.

HISTIDINE IS WITHIN RANGE:



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Histidine is a semi-essential amino acid that gives rise to the neurotransmitter histamine. Histidine protects neurons, assists with making new blood cells, reduces inflammation and oxidative stress, helps with tissue repair and growth. Histidine ameliorates fatigue, promotes clear thinking/concentration, reduces appetite, decreases anxiety, improves sleep and glucose homeostasis.

HISTAMINE LEVELS HIGH NORMAL:

Histamine is both a neurotransmitter and a modulator of the immune system that has anti-pain properties, plays a neuroprotective role in the brain, and contributes to optimal maintenance of cognition and memory.

Histamine stimulates wakefulness and decreases sleep, stimulates gastric acid production, increases metabolism, suppresses appetite, and prevents weight gain. Histamine is a potent vasodilator and a pro-inflammatory agent.

Urinary histamine is high in patients with burns, flushing disorder, food allergies, cystitis, polycythemia, and pregnancy.

Clinically, high histamine levels are implicated in allergies, depression, headaches, migraines, OCD, schizophrenia, sensitivity to chemicals, and sleep difficulties.

N-METHYLHISTAMINE IS WITHIN THE REFERENCE RANGE: N-Methylhistamine is a major metabolite of the neurotransmitter histamine.

PEA LEVELS WITHIN REFERENCE RANGE:

PEA, also known as phenethylamine, promotes energy, elevates mood, and regulates attention.

PEA also contributes to aggression, serves as a biomarker for ADHD, and prolongs the signaling of dopamine, norepinephrine, and serotonin.

TYROSINE WITHIN REFERENCE RANGE:

Tyrosine is obtained from diet (sesame seeds, cheese, soy, meat, nuts and fish) or synthesized in the body from the amino acid phenylalanine. Tyrosine serves as a constituent of proteins and gives rise to neurotransmitters, like dopamine, noradrenalin and adrenalin; and the trace-amine tyramine. Additionally, in the thyroid gland, tyrosine can also be iodinated to give rise to thyroid hormones. Tyrosine enhances cognitive performance, energy, and alertness, and improves memory after sleep deprivation. Tyrosine also prevents the depletion of central and peripheral catecholamines (dopamine, noradrenalin, adrenalin) induced by acute stress, thereby eliciting protective effects on behavioral and cardiovascular parameters in the body.

TYRAMINE IS WITHIN REFERENCE RANGE:

Tyramine is a trace amine derived from the amino acid tyrosine that is found naturally in food. Specifically, tyramine is found in aged, fermented cured or spoiled food where microbes with decarboxylase enzymes convert tyrosine to tyramine. These foods include aged cheeses, smoked fish, cured meats, wine, and some types of beer. In sensitive individuals, eating high amount of tyramine can trigger migraines and increase blood pressure.

DOPAMINE LEVELS LOW:

May be low due to chronic damage to Dopamine neurons, receptors, transporter, excess serotonin levels, chronic use of drugs of abuse, alcohol, nicotine, ADD drugs.

TREATMENT:

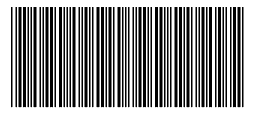
Tyrosine, B6, Cocoa, Rhodiola, Green tea, Carnitine, Theanine, Siberian ginseng, Dopamine inhibitors, Caffeine, Guarana, Yohimbine, Phenylalanine, L-Dopa, folic acid, thiamine, protein-rich diet.

DOPAC LOWER THAN THE REFERENCE RANGE:

DOPAC is the primary metabolite of dopamine formed via the actions of monoamine oxidase.

Research shows that DOPAC is reduced in the urine of patients with Alzheimer's disease.

HVA IS BELOW THE REFERENCE RANGE:



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Homovanillic acid (HVA) is a dopamine metabolite formed through the actions of the monoamine oxidase (MAO) and catechol-O-methyl transferase (COMT) enzyme. Research shows that HVA is reduced in the urine of patients with monoamine oxidase enzyme deficiency, polycystic ovarian syndrome, and periodic limb movement disorder.

NORADRENALIN LEVELS LOW:

Noradrenalin (Norepinephrine) functions both as a neurotransmitter and a hormone, participating in the body's "fight or flight" response. Noradrenalin increases alertness, focuses attention, fine-tunes vigilance, increases blood pressure, heart rate, and blood sugar, reduces digestive activity, pain, and sleep, prevents bladder emptying, and regulates body temperature. Noradrenalin is very similar in structure and physiological effects to Adrenalin. The adrenal gland produces approximately 20% of the total output with 80% produced by the sympathetic nerve fibers.

Urinary Noradrenalin is reduced in patients with Alzheimer's disease and may also be low due to the following: Toxic or other damage to Noradrenalin neurons, Depletion of stores (impact of stress and poor diet), Adrenal fatigue/exhaustion, Excess prostaglandin E2.

Clinically, low Noradrenalin is implicated in anorexia, attention impairment, depression, fatigue, hypotension, lack of motivation, lethargy, low mood, memory issues, slow pulse rate, and weight issues.

TREATMENT:

Precursor supplementation with tyrosine or phenylalanine, or cofactor support with ascorbic acid, iron, tetrahydrofolate, Cocoa, Rhodiola & Green tea and Vitamin C and vitamin B6 may be beneficial.

ADRENALIN LEVELS LOW NORMAL.

Adrenaline functions both as a neurotransmitter and a hormone, participating in the body's "fight or flight" response. Approximately 80% of peripheral catecholamine output by the adrenal glands is adrenaline.

Reduced urine adrenaline is seen in Alzheimer's disease, metabolic syndrome, and obesity. Clinically, low adrenaline is implicated in attention impairment, chronic stress, depression, cold body temperature, dizziness, chronic fatigue, hypotension, low mood and libido, and memory issues.

TREATMENT:

Adrenal support may be beneficial to increase adrenaline levels.

Methodology

Liquid Chromatography-Mass Spectrometry (LC-MS/MS/MS), Automated Chemistry/Immunochemistry