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26076-0111

Dr Test Doctor (Test Doctor) Test Clinic. 123 Test Street, Test

Lab ID
Patient ID P000066
Ext ID 26076-0111

Test Patient

Sex: Male 56yrs 01-Jan-70
123 Home Street, Test

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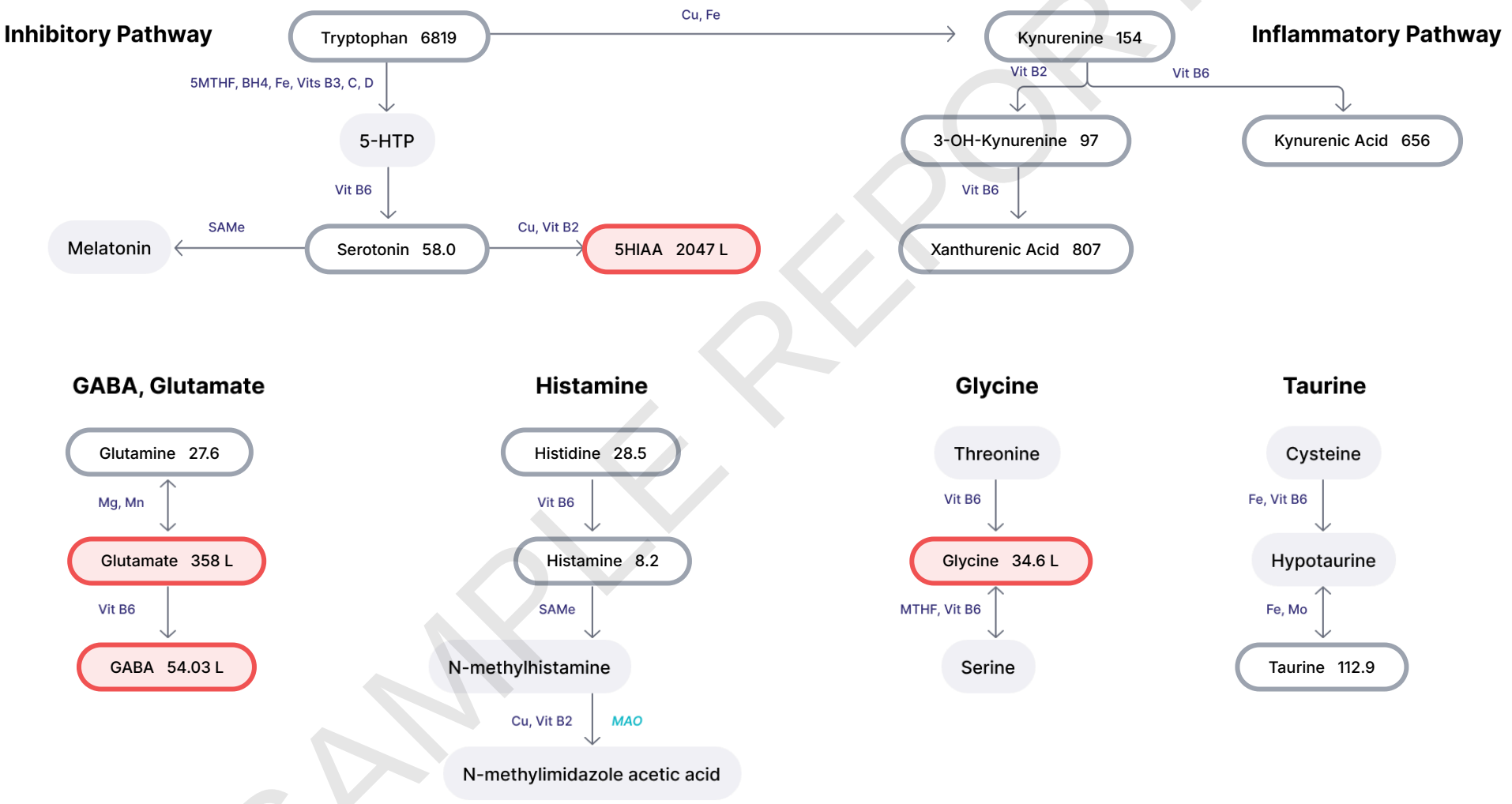
Clinical Notes On Melatonin Tablet. Tired all day, Low Stress Resistance, Poor Sleep.

Neurotransmitters - Advanced

Specimen type - Urine, Spot

Collected
12-May-26 10:57am

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



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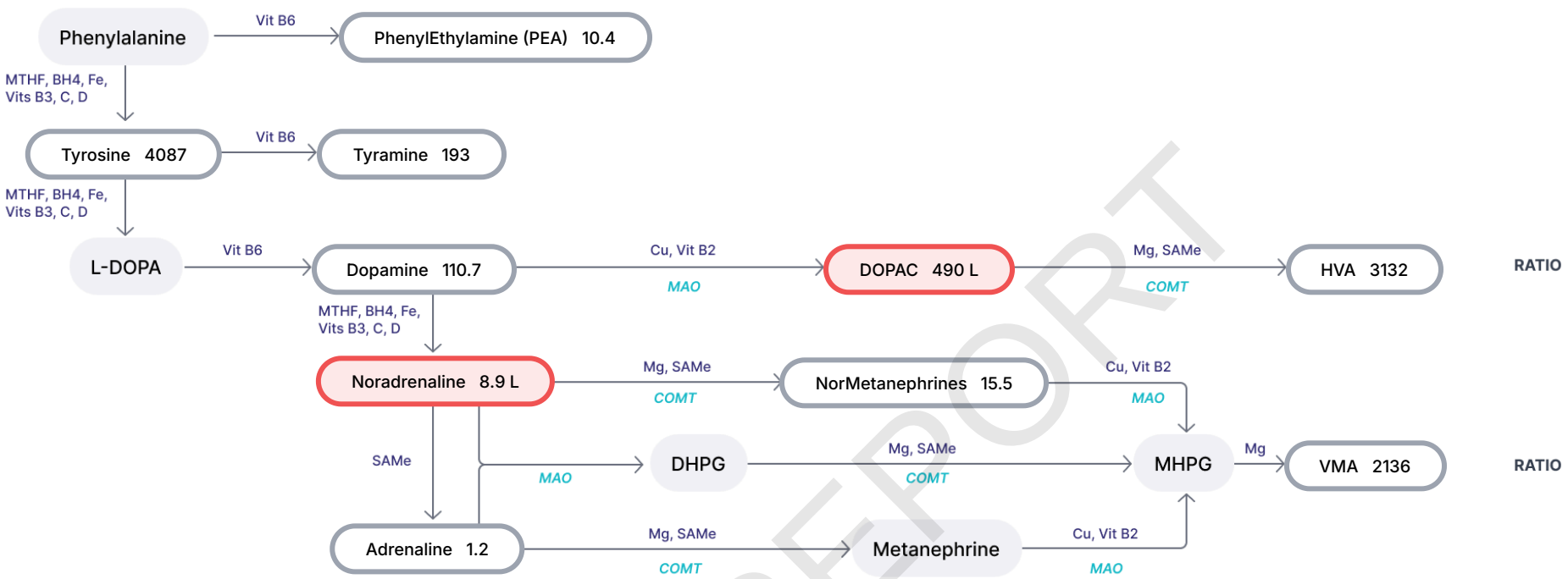
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Excitatory Pathway



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INHIBITORY NEUROTRANSMITTERS

TEST	RESULT	H/L	REFERENCE	UNITS
Tryptophan	6819		(2633-12688)	ug/gCR
Serotonin	58.0		(47.6-140.3)	ug/gCR
5HIAA	2047	L	(2205-11816)	ug/gCR
GABA	54.03	L	(167.00-463.00)	ug/gCR
Glycine	34.6	L	(41.0-295.0)	ug/gCR
Taurine	112.9		(7.1-293.0)	ug/gCR

NEUROINFLAMMATORY MARKERS

TEST	RESULT	H/L	REFERENCE	UNITS
Kynurenine	154		(108-1641)	ug/gCR
Kynurenic Acid	656		(437-1719)	ug/gCR
3-OH-Kynurenine	97		(80-822)	ug/gCR
Xanthurenic Acid	807		(450-2175)	ug/gCR

EXCITATORY NEUROTRANSMITTERS

TEST	RESULT	H/L	REFERENCE	UNITS
Glutamate	358	L	(1213-4246)	ug/gCR
Glutamine	27.6		(27.0-106.0)	ug/gCR
Histidine	28.5		(10.8-98.9)	ug/gCR
Histamine	8.2		(3.6-44.3)	ug/gCR
N-methylHistamine	67.6		(59.0-195.0)	ug/gCR
PhenylEthylamine (PEA)	10.4		(3.6-38.8)	ug/gCR
Tyrosine	4087		(3128-15548)	ug/gCR
Tyramine	193		(187-910)	ug/gCR
Dopamine	110.7		(103.0-282.0)	ug/gCR
DOPAC	490	L	(495-2456)	ug/gCR
HVA	3132		(3025-9654)	ug/gCR
Noradrenaline	8.9	L	(10.0-35.7)	ug/gCR
NorMetanephrines	15.5		(13.4-44.8)	ug/gCR
Adrenaline	1.2		(0.8-6.2)	ug/gCR
VMA	2136		(1996-5939)	ug/gCR
Noradrenaline/Adrenaline Ratio	7.2		(2.9-25.2)	ug/gCR
Creatinine, Urine	21.40		(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 NORMAL

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 LOWER THAN THE REFERENCE RANGE:

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 .

TREATMENT CONSIDERATIONS:

Increasing serotonin levels using 5-HTP or tryptophan and supporting conversion from serotonin with adequate levels of copper and vitamin B2 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.

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

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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

KYNURENINE IS LOW-NORMAL:

Kynurenine is a central metabolite of the amino acid tryptophan with vasodilatory properties. Kynurenine is utilized by the body in the production of niacin (vitamin B3), eventually leading to the formation of NAD+, which plays a pivotal role in energy metabolism, gene expression, cell death and regulation of calcium homeostasis. More than 90% of the body's tryptophan is metabolized to the kynurenine pathway. Kynurenine is synthesized by the enzyme tryptophan dioxygenase (TDO), which is made primarily but not exclusively in the liver, and indoleamine 2,3- dioxygenase (IDO), which is made in many tissues in response to immune activation by interferons and cytokines, or free radicals. In the brain, approximately ~40% of kynurenine is produced locally, whereas the rest is absorbed from the blood. Kynurenine degradation generates a series of neuroprotective and neurotoxic compounds that can activate or inhibit N-methyl-d-aspartate (NMDA) glutamate receptors (see kynurenic acid and 3-OH kynurenine). Upregulation of this pathway may be a hallmark of neuroinflammation and is associated with certain disorders. Research shows that urinary kynurenine levels are low in autism spectrum disorder. Low kynurenine levels have been implicated in aggression, depression and headaches.

TREATMENT CONSIDERATIONS:

Low kynurenine may be a sign of low tryptophan levels or low co-factors for the enzymatic metabolism.

3-HYDROXY-KYNURENINE IS LOW NORMAL:

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. Neurotoxicity elicited by 3-OH Kynurenine appears to be also related to generation of oxidative stress produced by reactive radical species, formed as a result of auto-oxidation. Additionally, 3-OH Kynurenine gives rise to neurotoxic metabolites, such as quinolinic acid, which activate the NMDA receptor, induce lipid peroxidation and promote oxidative stress.

Low 3-OH Kynurenine levels are implicated in headaches, in males in Alzheimer's disease and schizophrenia.

TREATMENT CONSIDERATIONS:

Consider tryptophan levels to assure there is enough upstream amino acids as well as B6 supplementation and magnesium to allow for ideal co-factors for enzyme conversions.

Excitatory Neurotransmitter Comment

HISTIDINE IS WITHIN RANGE:

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 IS WITHIN REFERENCE RANGE:

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.

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N-METHYLHISTAMINE IS LOW NORMAL:

N-Methylhistamine is a major metabolite of the neurotransmitter histamine. Research shows that N-methylhistamine in low in depression, in lupus, in focal segmental glomerulosclerosis, and in idiopathic nephrotic syndrome. Additionally, N-Methylhistamine levels can be low in individuals with an alteration in the histamine N-methyltransferase gene.

THERAPEUTIC CONSIDERATIONS: Evaluation of histidine levels is warranted as well as considering supplementation with methyl-donors.

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.

TYRAMINE IS LOW NORMAL:

Likely due to a diet low in processed or fermented foods and is of unknown significance. 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 and some types of beer. In sensitive individuals, high tyramine ingestion can trigger migraines. Additionally, tyramine has vasoactive properties and can increase blood pressure. While supplementation of tyramine is not needed, for people who have low blood pressure or low sympathetic tone incorporating higher tyramine foods may actually have some beneficial impacts.

DOPAMINE LEVELS LOW NORMAL.

Dopamine improves attention, focus, and motivation, helps with decision making, modulates movement control, promotes lactation, increases blood pressure, urine output and sodium excretion, and allows for feelings of reward and pleasure. Additionally, dopamine plays a central role in the etiology of addiction. Dopamine also serves as the parent precursor to norepinephrine and epinephrine.

Reduced urinary dopamine levels seen in patients with Alzheimer's disease, anorexia nervosa, anxiety with depression, fibromyalgia, and periodic limb movement disorder.

Clinically, low dopamine is also implicated in apathy, cravings, fatigue, impulse control issues, increased sensitivity to pain, low libido, low mood, memory issues, sleep disturbances, and weight control issues.

TREATMENT:

Supplementation with precursors (tyrosine or L-DOPA) and/or cofactors (iron, vitamin B6, tetrahydrofolate) to promote biosynthesis may be beneficial.

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 LOW NORMAL:

HVA is a dopamine metabolite formed through the actions of the monoamine oxidase and catechol-Omethyl transferase 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 Noradrenalin. The adrenal gland produces approximately 20% of the total output with 80% produced by the sympathetic nerve fibers.

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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 adrenalin.

Reduced urine adrenalin is seen in Alzheimer's disease, metabolic syndrome, and obesity. Clinically, low adrenalin 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 adrenalin levels.

Methodology

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

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