The COMT (catechol-O-methyltransferase) gene codes for the essential COMT enzyme that is involved in the inactivation of catecholamines such as dopamine, epinephrine, norepinephrine, and catecholestrogens. Scientific research has demonstrated that a common mutation in the COMT locus results in the replacement of the amino acid valine with methionine at position 158 in the enzyme. This causes a dramatic reduction in the enzyme's ability to metabolize these neurotransmitters and catecholestrogens. The enzyme is notably active in the prefrontal cortex (PFC), the area of the brain that gives rise to what we perceive as personality, emotions, behavior inhibition, abstract thinking, and short-term memory. Val/Val allele carriers have higher enzyme activity resulting in greater stress resiliency and lower dopamine levels, while Met/Met allele carriers have lower enzyme activity resulting in reduced stress resiliency and higher dopamine levels. Heterozygous Val/Met allele carriers exhibit an intermediate enzyme activity. Polymorphisms in the COMT gene have been implicated in association with various mental health disorders through the resulting changes in dopamine levels. Depending on the variant, associated disorders include drug abuse, alcohol abuse, severity of schizophrenic symptoms, obsessive compulsive disorder in men, panic disorder, post-traumatic stress disorder, and bipolar affective disorder. Having a particular polymorphism does not mean that someone will develop one or more of the associated disorders.

### Summary of Likely Patterns Associated with COMT Alleles

<table>
<thead>
<tr>
<th>GENE ALLELE</th>
<th>ENZYME ACTIVITY</th>
<th>DOPAMINE LEVELS</th>
<th>PAIN RESPONSE</th>
<th>PAIN MED NEED</th>
<th>STRESS RESILIENCY</th>
<th>ESTRADIOL LEVELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Val/Val</td>
<td>HIGH</td>
<td>LOWER</td>
<td>MORE TOLERANCE</td>
<td>POSSIBLE HIGHER DOSE</td>
<td>HIGHER</td>
<td>LIKELY LOWER</td>
</tr>
<tr>
<td>Val/Met</td>
<td>BALANCED</td>
<td>AVERAGE</td>
<td>AVERAGE</td>
<td>AVERAGE</td>
<td>AVERAGE</td>
<td>AVERAGE</td>
</tr>
<tr>
<td>Met/Met</td>
<td>LOW</td>
<td>HIGHER</td>
<td>MORE ACUTE</td>
<td>PROBABLY LOWER DOSE</td>
<td>REDUCED</td>
<td>LIKELY HIGHER</td>
</tr>
</tbody>
</table>
COMT polymorphisms have been linked to pain sensitivity. It has been suggested that a reduction in dopamine inactivation, such as is seen with the Met/Met genotype, results in higher levels of dopamine, leading to chronic stimulation of the dopamine receptors. This overstimulation may result in less endogenous opioids being produced that help to provide pain relief and euphoria. Therefore, Met/Met allele carriers can perceive a higher level of pain, while Val/Val carriers have the greatest resistance to pain. Interestingly, studies have shown that Met/Met allele carriers require less morphine to achieve pain relief, possibly due to the increase in µ-opioid receptors seen with this genotype, while Val/Val allele carriers require the most medication for pain management. COMT also has been shown to have an effect on L-DOPA therapy in Parkinson's disease treatment. Commonly COMT inhibitors, such as entacapone, are utilized in Parkinson's treatment to augment and prolong L-DOPA treatment. COMT polymorphisms affect the bioavailability of these medications, yielding a heightened effect of entacapone in the Val/Val allele carriers as compared to Met/Met allele carriers.

ESTRADIOL INFORMATION

COMT has also been demonstrated to play a role in estrogen metabolism through inactivation of the catecholestrogens. Catecholestrogens are formed during the metabolism of estrogens such as estradiol. Catecholestrogen inactivation decreases the cancer-causing potential of these metabolites, while simultaneously increasing the amount of 2-methoxyestradiol, a metabolite that has been shown to inhibit the growth of breast cancer cells. Additionally, COMT polymorphisms have been shown to exert an effect on estradiol levels. As Met/Met allele carriers exhibit a 2-3 fold decrease in their ability to degrade catecholestrogens, this results in higher estradiol levels than Val/Val allele carriers. Estradiol clearance is also diminished in both the Met/Met and Met/Val genotypes as opposed to Val/Val genotypes, however there is no significant difference in estrone levels.

ENZYMATIC PROCESS OF COMT (RELATED TO ESTROGEN STATUS AND CANCER RISKS)
Heterozygous Valine/Methionine (Val/Met) allele carriers have balanced dopamine levels. Increasing certain amino acids without proper balance of all neurotransmitters can result in increased cognitive symptoms. 

- SAMe is an important methyl group donor involved in many of the biochemical and enzyme structures in the body. Specifically, it is involved in the synthesis of the COMT enzyme, and in folate metabolism. Additionally, SAMe may be useful in the treatment of depression. 
- Magnesium is required for the proper synthesis of the COMT enzyme, and for the proper function of many other enzyme complexes throughout the body. Deficiency is associated with depression and poor cognition.
- Green tea may suppress COMT function, increase dopamine release, and suppress the production of reactive oxygen species, thereby inhibiting inflammatory responses. Additionally, intake of caffeine may modulate dopamine neurotransmission in conditions with dopamine deficiency.
- Active B Complex vitamins are associated with proper methylation of enzymes throughout the body and may lower homocysteine, where high levels of homocysteine are associated with cognitive impairment.
- Estrogen Metabolism is mildly diminished in heterozygous Val/Met allele carriers, and as a result it may be useful to improve metabolism through dietary intervention with ground flax seed daily.
- COMT expression is inhibited by estrogens, thus COMT activity is lower in females than males, and the sex/hormonal status of each individual should be considered while balancing hormones. Additionally, estrogen enhances dopamine effects, further emphasizing the importance of appropriately balancing hormones.

NOTICE: This information does not take into consideration patient health history, interaction with other medications or supplements, and/or allergies. It is the responsibility of the physician to determine appropriate dosing choices based on all clinical data.

This test detects only specific targeted genetic variations and there is a possibility that other genetic variants not detected by this test may be present. The DNA variants tested for in this report have been scientifically determined to be possible risk factors for the reported condition. The content of this report is provided for informational purposes only, not as a diagnostic tool. The report does not supersede the judgment of a qualified medical provider. This test is not a substitute for a comprehensive consideration of all factors that influence the maintenance of a healthy body. Genetic risk factors are not guarantees that you will develop a condition, and in many cases, the presence of a particular DNA variant may only play a minor role in your risk for disease, compared with environmental and lifestyle factors. This test is not FDA approved. The test’s performance characteristics have been established and maintained by Kashi Clinical Laboratories under CLIA and CAP compliance.

SCIENTIFIC REFERENCES

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