



# Trimethylaminuria Phenotype Test

## Your Results

Thank you for initiating your test with MEBO Research, Inc. ("MEBO") through the Cleveland Clinic.

*Please Note : The results are part of a broader research study and indicate the levels of compounds in the urine sample. It is not a medical diagnosis, and should not be considered as such. It is only provided for informational purposes.*

\*Please read the accompanying notes below about this service.

<b>Name and ID Number</b>	
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### Your sample results

	Result	Normal Ranges	Comment
<b>TMA*</b> (umol/mmol creatinine)			
<b>TMAO*</b> (umol/mmol creatinine)			
<b>Creatinine*</b> (mmol/L)			

**TMA** - trimethylamine | **TMAO** - trimethylamine-n-oxide | TMA and TMAO measured in **umol/mmol** creatinine | **creatinine** - measured in **mmol/L**

From this data we can work out

	Result	Normal ranges	Comment
TMAO/(TMA + TMAO)			
TMA/TMAO ratio			

## Comments :

**Comments:** You oxidized \_% of the TMA

The amount of TMA you were left with was \_

*\*Note: Testing performed at Cleveland Clinic Prevention Research Lab. This is not a medical diagnosis and should not be interpreted as such.*

Additional questions about your results : email [tmauresult@meboresearch.org](mailto:tmauresult@meboresearch.org)

For general information, included are the reference ranges of other TMAU testing laboratories. Please note there is no international standard reference range, and each reference range will vary and is subject to change by each laboratory.

### Reference ranges of other labs

Lab	Reference ranges	Comment
Arkansas	TMA - normal <6.8	Does not test TMAO
HBRI	TMAO/(TMA + TMAO) >95%	Does not consider TMA level alone
Denver	ratio TMAO/TMA >92%	Does not consider TMA level alone

### \*Important Accompanying Notes:

Testing results should not be interpreted as a medical diagnosis. Only a medical doctor can give a diagnosis. The samples were tested to clinical standards by the Cleveland Clinic using Liquid Chromatography/Tandem Mass Spectrometry.

In order to further research at a broader level and provide tools for self help, MEBO will maintain a copy of your test results. All personal information will remain private. MEBO may make available your test result figures, withholding any names, publicly on its website or blogs. If you do not want MEBO to maintain a record of these test results, please contact [tmauresult@meboresearch.org](mailto:tmauresult@meboresearch.org).

If you are further interested in the genetic mutants/variants associated with TMAU, there are TMAU DNA tests available.

### Notes about Trimethylaminuria (TMAU)

TMA is converted to TMA-oxide (TMAO) by the FMO3 enzyme (mostly situated in the liver). TMA is odorous, whereas TMA-oxide is not.

**Primary TMAU (TMAU1):** defined as being caused by a FMO3 deficiency, usually genetic. Typical pattern is a higher than normal TMA level and lower TMAO level. TMAO output is less than 80% of total TMA presented to the FMO3 enzyme (TMA + TMAO), in other words ratio of TMA/TMAO is higher than 0.21. TMAU1 is generally regarded as the inability to convert normal levels of TMA to TMAO (FMO3 deficiency).

**Secondary TMAU (TMAU 2) :** defined as being a raised TMA level when the TMAO level does not seem low in comparison. Typical pattern is above normal TMA and increased TMAO, with TMA/(TMAO + TMA) still being above 81%. Most labs do not seem to take TMAU2 into consideration (i.e. not calculated).

TMAU2 is regarded as being an excess of TMA being presented to the liver, with normal levels of TMAO produced (substrate overload). Raised TMA levels is often regarded as being produced by bacterial overgrowth in the gut.

### How might trimethylaminuria be treated:

Although there is no cure for trimethylaminuria, it is possible for people with this condition to live normal, healthy lives. Strategies for the treatment of trimethylaminuria covered in detail in Cashman et al [2003] [3], and in "best-practice" guidelines [1]. Dr. Ian Phillips and Eileen Shephard recommend a treatment plan to reduce symptoms [11], as noted in the National Institutes of Health, Office of Rare Diseases Research, article, [Trimethylaminuria](#).

## Additional TMAU Information

- Trimethylaminuria. NCBI Bookshelf, A service of the National Library of Medicine, National Institutes of Health Web site. 2011 Available at: <http://www.ncbi.nlm.nih.gov/books/NBK1103/#trimethylaminuria>. Accessed May 31, 2011.
- Trimethylaminuria. National Institutes of Health, Office of Rare Diseases Research, Genetic and Rare Diseases Information Center (GARD) Web site. 2010 Available at <http://rarediseases.info.nih.gov/GARD/QnA.aspx?PageID=4&CaseID=20839&DiseaseID=6447#78>. Accessed May 31, 2011.
- Learning about Trimethylaminuria. National Human Genome Research Institute Web site. 2009 Available at: <http://www.genome.gov/11508983>. Accessed May 31, 2011.
- Trimethylaminuria. Genetics Home Reference Web site. April 2007 Available at: <http://ghr.nlm.nih.gov/condition=trimethylaminuria>. Accessed May 31, 2011.
- Trimethylaminuria. MEBO Research, A Patient Advocacy International Campaign Web site. 2011 Available at <http://www.meboresearch.org/trimethylaminuria.html>.

## Suggested Reading

1. Chalmers RA, Bain MD, Michelakakis H, Zschocke J, Iles RA. Diagnosis and management of trimethylaminuria (FMO3 deficiency) in children. 2006. Available [online](#). Accessed 4-12-11.
2. Cashman JR, Camp K, Fakhrazadeh SS, Fennessey PV, Hines RN, Mamer OA, Mitchell SC, Nguyen GP, Schlenk D, Smith RL, Tjoa SS, Williams DE, Yannicelli S. Biochemical and clinical aspects of the human flavin-containing monooxygenase form 3 (FMO3) related to trimethylaminuria. *Curr Drug Metab*. 2003;4:151–70. [\[PubMed\]](#)
3. Mamer OA, Choiniere L, Lesimple A. Measurement of urinary trimethylamine and trimethylamine oxide by direct infusion electrospray quadrupole time-of-flight spectrometry. *Anal Biochem*. 2010;406:80–2. [\[PubMed\]](#)
4. Mamer OA, Choiniere L, Treacy EP. Measurement of trimethylamine and trimethylamine N-oxide independently in urine by fast atom bombardment mass spectrometry. *Anal Biochem*. 1999;276:144–9. [\[PubMed\]](#)
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7. Mitchell SC, Smith RL. Trimethylaminuria: the fish malodor syndrome. *Drug Metab Dispos*. 2001;29:517–2.
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9. Pardini RS, Sapien RE. Trimethylaminuria (fish odor syndrome) related to the choline concentration of infant formula. *Pediatr Emerg Care*. 2003;19:101–3. [\[PubMed\]](#)
10. Phillips IR, Francois AA, Shephard EA. The flavin-containing monooxygenases (FMOs): genetic variation and its consequences for the metabolism of therapeutic drugs. *Curr Pharmacogenet Pharmacogenom*. 2007;5:292–313.
11. Phillips IR, Shephard EA. Trimethylaminuria. *GeneReviews* Web site. March 18, 2008 Available at: <http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=gene&part=trimethylaminuria>. Accessed July 21, 2010.
12. Shimizu M, Cashman JR, Yamazaki H. Transient trimethylaminuria related to menstruation. *BMC Med Genet*. 2007;8:2. [\[PubMed\]](#)
13. Treacy EP, Akerman BR, Chow LM, Youil R, Bibeau C, Lin J, Bruce AG, Knight M, Danks DM, Cashman JR, Forrest SM. Mutations of the flavin-containing monooxygenase gene (FMO3) cause trimethylaminuria, a defect in detoxication. *Hum Mol Genet*. 1998;7:839–45. [\[PubMed\]](#)
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