Use a keyword, test name or number

TMAO (Trimethylamine N-oxide)

TEST: 123413 CPT: 84999

Special Instructions	This assay is currently not available in New York state.
Related Documents	For more information, please view the literature below. TMAO (Trimethylamine N-oxide) Test Technical Review • Sample Report

SPECIMEN REQUIREMENTS

Specimen	Serum **or** plasma, shipped refrigerated
Volume	1 mL
Minimum Volume	0.5 mL
Container	Spun NMR LipoTube (black-and-yellow-top tube) is the preferred container; lavender-top (EDTA) tubes or green-top (Na heparin) tubes or plain red-top (no gel) tubes are also acceptable specimens.
Collection	Keep NMR LipoTube (black-and-yellow-top tube) upright at room temperature for 30 minutes and allow to clot. Centrifuge at 1800 to 2200g for 10 to 15 minutes immediately after clotting. If the sample cannot be centrifuged immediately, it must be refrigerated at (2°C to 8°C) and centrifuged within 24 hours of collection. The NMR tube should then be stored at (2°C to 8°C) until shipped. Do **not** open NMR LipoTube. For specimens collected in plain red-top tube, hold tube upright at room temperature for 45 minutes and allow to clot. Centrifuge specimen after clotting according to manufacturer's specifications. Transfer to a transport tube for storage at (2°C to 8°C) until shipped. Serum drawn in gel-barrier collection tubes other than the NMR LipoTube should not be used. Plasma must be separated from cells within 45 minutes of venipuncture. Send plasma in a plastic transfer tube.
Storage Instructions	Refrigerate.

Stability Requirements

Temperature	Period
Room temperature	14 days
Refrigerated	14 days
Frozen	14 days
Freeze/thaw cycles	Stable x3

Patient Preparation	TMAO levels are lower in humans who follow a vegetarian or vegan diet than in omnivores.[3] Because TMA and TMAO are naturally abundant in some fish,[7,8] patients should fast overnight and refrain from consuming fish and other marine food items the day before the blood draw. Fasting for 10 to 12 hours is recommended.
Causes for Rejection	Unspun LipoTube; serum specimen drawn in gel-barrier collection tube other than the NMR LipoTube; sample older than 14 days

TEST DETAILS

Use	High levels of TMAO have been associated with an increased risk of heart disease.[1]

The TMAO test may be used as (1) an aid in the assessment of risk for cardiovascular disease (CVD), independent of established risk factors, (2) an aid in the determination of altered gut microbiome (gut dysbiosis) in individuals who may benefit from intensive dietary intervention, and (3) a monitor therapy aimed at reducing TMAO concentrations.

Limitations

This test was developed and its performance characteristics determined by Labcorp. It has not been cleared or approved by the Food and Drug Administration.

Methodology

Nuclear magnetic resonance (NMR)

Reference Interval

TMAO Medical Decision Limits	
Low	<6.2 µM
Moderate	6.2−9.9 µM
High	>9.9 µM

Additional Information

TMAO is a dietary metabolite produced by a pathway involving gut microbiota. TMAO concentrations increase in the blood after ingestion of dietary choline and L-carnitine, which are abundant in meat, eggs, liver, and wheat germ and energy drinks. Choline and L-carnitine are metabolized in the gut by microbiota to form trimethylamine (TMA), which is subsequently oxidized in the liver into TMAO by flavin monooxygenases (FMOs). TMAO concentrations have been shown to be reduced in animals and humans treated with broad-spectrum oral antibiotics confirming the requirement for gut bacteria in the formation of TMA and TMAO.[2-6] TMAO has been hypothesized to promote atherosclerosis by upregulating macro-phage scavenger receptor activity and downregulating bile acid synthesis which together reduce reverse cholesterol transport.[2-6]

Footnotes

1. Garcia E, Wolak-Dinsmore J, Wang Z, et al. NMR quantification of trimethylamine-N-oxide in human serum and plasma in the clinical laboratory setting. *Clin. Biochem.* 2017 Nov;50(16-17):947-955. PubMed 28624482
2. Wang Z, Klipfell E, Bennett BJ, et al. Gut flora metabolism of phosphatidylcholine promotes cardiovascular disease. *Nature.* 2011 Apr 7;472(7341):57-63. PubMed 21475195
3. Koeth RA, Wang Z, Levison BS, et al. Intestinal microbiota metabolism of l-carnitine, a nutrient in red meat, promotes atherosclerosis. *Nat Med.* 2013 May;19(5):576-585. PubMed 23563705
4. Tang WH, Wang Z, Levison BS, et al. Intestinal microbial metabolism of phosphatidylcholine and cardiovascular risk. *New Eng J Med.* 2013 Apr 25;368(17):1575-1584. PubMed 23614584
5. Zhu W, Gregory JC, Org E, et al. Gut Microbial Metabolite TMAO Enhances Platelet Hyperreactivity and Thrombosis Risk. *Cell.* 2016 Mar 24;165(1):111-124. PubMed 26972052
6. Senthong V, Li XS, Hudec T, et al. Plasma Trimethylamine N-Oxide, a Gut Microbe-Generated Phosphatidylcholine Metabolite, Is Associated With Atherosclerotic Burden. *J Am Coll Cardiol.* 2016 Jun 7;67(22):2620-2628. PubMed 27256833
7. Lundstrom RC, Racicot LD. Gas chromatographic determination of dimethylamine and trimethylamine in seafoods. *J Assoc Off Anal Chem.* 1983 Sep;66(5):1158-1163. PubMed 6630129
8. Svensson BG, Akesson B, Nilsson A, Paulsson K. Urinary excretion of methylamines in men with varying intake of fish from the Baltic Sea. *J Toxicol Environ Health.* 1994 Apr;41(4):411-420. PubMed 8145282