MAYO CLINIC LABORATORIES

Test Definition: VITB3

Vitamin B3 and Metabolites, Plasma

Overview

Useful For

Assisting in the diagnosis of suspected vitamin B3 deficiency or toxicity

May be useful in determining response to therapy

Method Name

Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS)

NY State Available

Yes

Specimen

Specimen Type

Plasma EDTA

Specimen Required

Patient Preparation: Fasting 4 to 8 hours preferred
Supplies: Sarstedt Aliquot Tube 5 mL (T914)
Collection Container/Tube:
Preferred: Lavender top (K2 EDTA)
Acceptable: K3 EDTA
Submission Container/Tube: Plastic vial
Specimen Volume: 1.5 mL
Collection Instructions: Centrifuge and aliquot plasma into a plastic vial within 2 hours of collection.

Specimen Minimum Volume

0.75 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container

Plasma EDTA	Ambient	21 days	
	Refrigerated (preferred)	28 days	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

Vitamin B3 is the term used for a group of closely related water-soluble pyridine derivatives, primarily derived from tryptophan. Niacin (also known as nicotinic acid) is converted to nicotinamide, which can also be synthesized directly from tryptophan. Nicotinamide serves as the precursor of nicotinamide adenine dinucleotide (NAD) and NAD phosphate (NADP), essential coenzymes for numerous dehydrogenases. Many of these enzymes play a role in energy release from carbohydrates and fats, but numerous other pathways are also NAD/NADP dependent, ranging from intra- and inter-cell signaling, to DNA repair, to fatty acid-, cholesterol- and steroid hormone synthesis, and many other vital biochemical functions.

Nicotinuric acid is a major inactive metabolite of niacin and nicotinamide.

Vitamin B3 deficiency most severely impacts tissues with high energy requirements or high turnover. Thus, the skin, the gastrointestinal tract, and the brain are primarily affected, but the function of numerous other organ systems, such as bone marrow and heart, might also be impaired. Severe vitamin B3 deficiency manifests as a distinct clinical syndrome, called pellagra, which is clinically characterized by the "3Ds": dermatitis, diarrhea, and dementia; if untreated, it will result in death.

The onset of deficiency symptoms is subacute or chronic.

The most common cause of vitamin B3 deficiency is inadequate dietary intake of niacin or tryptophan. At-risk populations are older adults, those with limited income, and those who are malnourished or suffer from malabsorption. Malnourished individuals with severe chronic alcoholism are at particularly high risk, as high alcohol intake impairs absorption of niacin and tryptophan as well as further downstream liver metabolism to bioactive of vitamin B3 compounds.

Liver disease in general is also a risk factor, as nicotinamide is derived in the liver from tryptophan. This process requires vitamins B6, B2, and iron, so deficiencies of any of these factors might also predispose the individual to vitamin B3 deficiency.

Issues that impact the availability of tryptophan for vitamin B3 synthesis can also lead to deficiency. Examples include:
-Hartnup disease, a hereditary disorder that reduces tryptophan absorption
-Carcinoid syndrome, a gastro-entero-pancreatic neuroendocrine tumor disorder that results in serotonin overproduction, with the majority of available tryptophan being channeled into serotonin synthesis
-Various drugs (eg, isoniazid, chloramphenicol, fluorouracil, mercaptopurine)

In most cases, vitamin B3 supplementation should result in a cure, even if the deficiency has progressed to the state of pellagra.

Vitamin B3 toxicity is much less common than deficiency. Its occurrence is essentially limited to individuals who consume vitamin B3 supplements in extremely excessive doses or to patients who are prescribed niacin for treatment of hypercholesterolemia, as the doses used in this setting are very high. Common symptoms are flushing, itching, dizziness, tachycardia, nausea and vomiting, diarrhea, and gout. Rarely liver damage or stroke has been observed. The onset of symptoms is acute or subacute.

Reference Values

Nicotinic Acid (Niacin) Cutoff: <5.0 ng/mL

Nicotinamide: 5.0-48.0 ng/mL
Nicotinuric Acid Cutoff: <5.0 ng/mL

Interpretation

Nicotinamide concentrations below the established reference range indicate a deficiency.

Niacin or nicotinamide concentrations that exceed the upper reference range substantially suggest potential toxicity in patients with excessive supplement intake or under niacin treatment for hypercholesterinemia.

Cautions

Testing of nonfasting specimens can result in elevated plasma vitamin B3 concentrations, particularly in patients with dietary supplement use or patients on niacin treatment.

Clinical Reference

1. Delgado-Sanchez L, Godkar D, Niranjan S: Pellagra. Rekindling of an old flame. Am J Ther. 2008;15(2):173-175. doi: 110.1097/MJT.1090b1013e31815ae31309
2. EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA): A Scientific opinion on dietary reference values for niacin. EFSA Journal. 2014;12(7):3759. doi: 10.2903/j.efsa.2014.3759
3. Expert Group on Vitamins and Minerals: Safe Upper Levels for Vitamins and Minerals. Food Standard Agency; 2003:1-361. Accessed April 23, 2024. Available at https://cot.food.gov.uk/sites/default/files/vitmin2003.pdf
4. Fu CS, Swendseid ME, Jacob RA, McKee RW. Biochemical markers for assessment of niacin status in young men: Levels of erythrocyte niacin coenzymes and plasma tryptophan. J Nutr. 1989;119(12):1949-1955
5. Powers HJ. Current knowledge concerning optimum nutritional status of riboflavin, niacin and pyridoxine. Proc Nutr Soc. 1999;58(2):435-440
6. Shah GM, Shah RG, Veillette H, et al. Biochemical assessment of niacin deficiency among carcinoid cancer patients. Am J Gastroenterol. 2005;100(10): 2307-2314. doi: 2310.1111/j.1572-0241.2005.00268.x
7. Sun WP, Zhai MZ, Li D, et al. Comparison of the effects of nicotinic acid and nicotinamide degradation on plasma betaine and choline levels. Clin Nutr. 2017;36(4):1136-1142

Performance

Method Description

Vitamin B3 components (nicotinic acid/niacin, nicotinamide, nicotinuric acid) are extracted from plasma specimens with internal standard and then analyzed by liquid chromatography tandem mass spectrometry.(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Monday, Tuesday, Thursday, Friday

Report Available

2 to 4 days

Specimen Retention Time

2 weeks

Performing Laboratory Location

Rochester

Fees & Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification

This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

84591

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
VITB3	Vitamin B3 and Metabolites, P	102102-1

Result ID	Test Result Name	Result LOINC® Value
609493	Nicotinic Acid (Niacin)	18244-4
609494	Nicotinamide	56961-6
609495	Nicotinuric Acid	72306-4