MAYO CLINIC LABORATORIES

Test Definition: TDP

Thiamine (Vitamin B1), Whole Blood

Overview

Useful For

Assessment of thiamine deficiency

Measuring thiamine levels in patients with behavioral changes, eye signs, gait disturbances, delirium, and encephalopathy; or in patients with questionable nutritional status, especially those who appear at risk and who also are being given insulin for hyperglycemia

Highlights

-Whole blood thiamine testing is superior to currently available alternative tests for assessing thiamine status. Serum or plasma thiamine testing suffers from poor sensitivity and specificity, and less than 10% of blood thiamine is contained in plasma.

-Thiamine diphosphate (TDP) is the active form of thiamine and is most appropriately measured to assess thiamine status. Thiamine diphosphate in circulating blood is present in erythrocytes but is undetectable (present in very low levels) in plasma or serum.

-Liquid chromatography-tandem mass spectrometry analysis of TDP in whole blood is the most sensitive, specific, and precise method for determining the nutritional status of thiamine and is a reliable indicator of total body stores.

-This assay specifically targets and quantitates the active form of thiamine, TDP, as an indicator of thiamine status.

Method Name

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

NY State Available

Yes

Specimen

Specimen Type

Whole Blood EDTA

Shipping Instructions

Ship specimen in amber vial to protect from light.

Specimen Required

Patient Preparation: Fasting overnight (12-14 hours). Infants-collect prior to next feeding. Water can be taken as needed.

Supplies: Sarstedt 5 mL Aliquot Tube (Amber) (T915)

Collection Container/Tube: Lavender top (EDTA)
Submission Container/Tube: Amber vial
Specimen Volume: 4 mL
Collection Instructions:
1. Invert 8 to 10 times to mix blood.
2. Transfer whole blood into amber vial or tube and freeze within 24 hours of collection.

Forms
If not ordering electronically, complete, print, and send a General Request (T239) with the specimen.

Specimen Minimum Volume
0.5 mL

Reject Due To

Gross lipemia	Reject
Glass vial Clotted specimen	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole Blood EDTA	Frozen	28 days	LIGHT PROTECTED

Clinical & Interpretive

Clinical Information
Thiamine (vitamin B1, thiamin) is an essential vitamin required for carbohydrate metabolism, brain function, and peripheral nerve myelination. Thiamine is obtained from the diet. Body stores are limited, and deficiencies can develop quickly. The total thiamine pool in the average adult is about 30 mg. An intake of 0.5 mg per 1000 kcal per day is needed to maintain this pool. Due to its relatively short storage time, marginal deficiency can occur within 10 days and more severe deficiency within 21 days if intake is restricted.

Approximately 80% of all chronic alcoholics are thiamine deficient due to poor nutrition. However, deficiency also can occur in individuals who are older adults, have chronic gastrointestinal problems, have marked anorexia, are on cancer treatment, or are receiving diuretic therapy.

The signs and symptoms of mild-to-moderate thiamine deficiency are nonspecific and may include poor sleep, malaise, weight loss, irritability, and confusion. Newborns breastfed from deficient mothers may develop dyspnea and cyanosis; diarrhea, vomiting, and aphonia may follow. Moderate deficiency can affect intellectual performance and well-being, despite a lack of apparent clinical symptoms.

Severe deficiency causes congestive heart failure (wet beriberi), peripheral neuropathy (dry beriberi), Wernicke

encephalopathy (a medical emergency that can progress to coma and death), and Korsakoff syndrome (an often irreversible memory loss and dementia that can follow). Rapid treatment of Wernicke encephalopathy with thiamine can prevent Korsakoff syndrome. Symptoms of dry beriberi include poor appetite, fatigue, and peripheral neuritis. Symptoms of wet beriberi include cardiac failure and edema. Patients with Wernicke encephalopathy present with behavior change (confusion, delirium, apathy), diplopia (often sixth nerve palsies), and ataxia. A late stage, in which the patients may develop an irreversible amnestic confabulatory state, is referred to as the Wernicke-Korsakoff syndrome.

The response to thiamine therapy in deficient patients is usually rapid. Thiamine deficiency is a treatable, yet underdiagnosed, disorder in the United States. A heightened level of awareness of the possibility of thiamine deficiency is necessary to identify, intervene, and prevent thiamine deficiency's dire consequences. It appears that no conditions are directly attributable to thiamine excess and that thiamine administration is safe except in extremely rare cases of anaphylaxis from intravenous thiamin.

Whole blood thiamine testing is superior to currently available alternative tests for assessing thiamine status. Serum or plasma thiamine testing suffers from poor sensitivity and specificity, and less than 10% of blood thiamine is contained in plasma. Transketolase determination, once considered the most reliable means of assessing thiamine status, is now considered an inadequate method. The transketolase method is an indirect assessment. Since transketolase activity requires thiamin, decreased transketolase activity is presumed to be due to the decrease of thiamin. However, the test is somewhat nonspecific, as other factors may decrease transketolase activity. Transketolase is less sensitive than liquid chromatography-tandem mass spectrometry), has poor precision, and specimen stability concerns.

Reference Values

70-180 nmol/L

Interpretation

Values for thiamine diphosphate of less than 70 nmol/L are suggestive of thiamine deficiency.

Cautions

Vitamin supplementation and nonfasting specimens may result in elevated thiamine diphosphate concentrations.

Clinical Reference

1. Naidoo DP, Bramdev A, Cooper K: Wernicke's encephalopathy and alcohol-related disease. Postgrad Med J. 1991 Nov;67(793);978-981
2. Herve C, Beyne P, Letteron PH, Delacoux E: Comparison of erythrocyte transketolase activity with thiamin and thiamin phosphate ester levels in chronic alcoholic patients. Clin Chim Acta. 1995 Jan;234(1-2):91-100
3. Majumdar SK, Shaw GK, O'Gorman P, et al: Blood vitamin status (B1, B2, B6, folic acid, and B12) in patients with alcohol liver disease. Int J Vitam Nutr Res. 1982;52:266-271
4. Ball GFM: Vitamins: Their role in the human body. Blackwell Publishing; 2004:273-288
5. Brin M: Erythrocyte as a biopsy tissue for functional evaluation of thiamin adequacy. JAMA. 1964 Mar;187:762-766
6. Roberts NB, Taylor A. Sodi R: Vitamins and trace elements. In: Rifai N, Horwath AR, Wittwer CT, eds. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 6th ed. Elsevier; 2018:639-718

Performance

Method Description

Samples are extracted with methanol and an isotopically labeled internal standard. Following centrifugation, an aliquot of the supernatant is dried down and reconstituted. The analyte is then detected using liquid chromatography-tandem mass spectrometry.(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Monday through Thursday

Report Available

3 to 6 days

Specimen Retention Time

14 days

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

84425

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
TDP	Thiamin (Vitamin B1), WB	32554-8

Result ID	Test Result Name	Result LOINC® Value
85753	Thiamin (Vitamin B1), WB	32554-8