MAYO CLINIC LABORATORIES

Test Definition: FOL

Folate, Serum

Overview

Useful For
Investigation of suspected folate deficiency

Special Instructions
- Vitamin B12 Deficiency Evaluation

Method Name
Competitive-Binding Receptor Assay

NY State Available
No

Specimen

Specimen Type
Serum

Specimen Required
Patient preparation:
1. Fasting: 8 hours, required
2. **Do not order** on patients who have recently received methotrexate or other folic acid antagonists.
Supplies: Sarstedt Aliquot Tube, 5 mL (T914)
Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Plastic vial
Specimen Volume:0.6 mL Serum
Collection Instructions:
1. Within 2 hours of collection, centrifuge the specimen.
2. For red-top tubes aliquot the serum into a plastic vial.

Forms
If not ordering electronically, complete, print, and send a Benign Hematology Test Request Form (T755) with the specimen.

Specimen Minimum Volume
Serum: 0.5 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Frozen	90 days	

Clinical & Interpretive

Clinical Information

The term folate refers to all derivatives of folic acid. For practical purposes, serum folate is almost entirely in the form of *N*-(5)-methyl tetrahydrofolate.(1)

Approximately 20% of the folate absorbed daily is derived from dietary sources; the remainder is synthesized by intestinal microorganisms. Serum folate levels typically fall within a few days after dietary folate intake is reduced and may be low in the presence of normal tissue stores. Red blood cell folate levels are less subject to short-term dietary changes.

Significant folate deficiency is characteristically associated with macrocytosis and megaloblastic anemia. Lower than normal serum folate has also been reported in patients with neuropsychiatric disorders, in pregnant women whose fetuses have neural tube defects, and in women who have recently had spontaneous abortions.(2) Folate deficiency is most commonly due to insufficient dietary intake and is most frequently encountered in pregnant women or in alcoholics.

Other causes of low serum folate concentration include:
-Excessive utilization (eg, liver disease, hemolytic disorders, and malignancies)
-Rare inborn errors of metabolism (eg, dihydrofolate reductase deficiency, formiminotransferase deficiency, 5,10-methylenetetrahydrofolate reductase deficiency, and tetrahydrofolate methyltransferase deficiency)

Reference Values

> or =4.0 mcg/L
<4.0 mcg/L suggests folate deficiency

Interpretation

Serum folate is a relatively nonspecific test.(3) Low serum folate levels may be seen in the absence of deficiency, and normal levels may be seen in patients with macrocytic anemia, dementia, neuropsychiatric disorders, and pregnancy disorders.

Results below 4 mcg/L are suggestive of folate deficiency. The cutoff is based on consensus and was derived from the US NHANES III data.(4)

Evaluation of macrocytic anemias commonly requires measurement of the serum concentration of both vitamin B12 and folate; ideally, they should be measured simultaneously.

Serum folate measurement is preferred over red blood cell (RBC) folate measurement due to considerable analytic variability (coefficient of variation) of assays. Both results give the same interpretation (internal Mayo study); therefore, RBC folate quantitation is not recommended. Additional serum testing for homocysteine and methylmalonic acid (MMA) determinations may help distinguish between vitamin B12 and folate deficiency states. In folate deficiency, homocysteine levels are elevated and MMA levels are normal. In vitamin B12 deficiency, the analytic variability of both serum and RBC folate assays is considerable. Homocysteine and MMA levels are alternate determinates of folate deficiency.

Cautions

Patients with combined folate and iron deficiencies may not demonstrate the erythrocyte macrocytosis typical of folate deficiency anemia. In these patients, however, the red cell distribution width will typically be elevated.

Nonfasting specimens yield falsely elevated results.

Recent folic acid administration or dietary folate intake could result in normal or elevated values and possibly mask an underlying folate deficiency.

Folates other than *N*-(5)-methyltetrahydrofolate and folic acid antagonists (such as methotrexate) may, under some circumstances, be present in serum and will also be measured by this method.

In rare cases, some individuals can develop antibodies to mouse or other animal antibodies (often referred to as human anti-mouse antibodies [HAMA] or heterophile antibodies), which may cause interference in some immunoassays. Caution should be used in interpretation of results, and the laboratory should be alerted if the result does not correlate with the clinical presentation.

Clinical Reference

1. Fairbanks VF, Klee GG. Biochemical aspects of hematology. In: Burtis CA, Ashwood ER, eds: Tietz Textbook of Clinical Chemistry. Saunders Company; 1999:1690-1698
2. George L, Mills JL, Johansson AL, et al. Plasma folate levels and risk of spontaneous abortion. JAMA. 2002;288(15):1867-1873
3. Klee GG. Cobalamin and folate evaluation: measurement of methylmalonic acid and homocysteine vs vitamin B12 and folate. Clin Chem. 2000;46(8 Pt 2):1277-1283
4. de Benoist B. Conclusions of a WHO Technical Consultation on folate and vitamin B12 deficiencies. Food Nutr Bull. 2008;29(2 Suppl):S238-S244
5. Sodi R: Vitamins and trace elements. In: Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, eds. Tietz Textbook of Laboratory Medicine. 7th ed. Elsevier; 2023:chap 39

Performance

Method Description

The instrument used is a Beckman Coulter DXI 800. The Access Folate assay is a competitive-binding receptor assay. A

serum sample is treated to release folate from endogenous binding proteins. After neutralization of the reaction mixture, folate-binding protein, mouse antifolate-binding protein, folic acid-alkaline phosphatase conjugate, and goat antimouse capture antibody coupled to paramagnetic particles are added to the reaction vessel. Folate in the sample competes with the folic acid-alkaline phosphatase conjugate for binding sites on a limited amount of folate-binding protein. Resulting complexes bind to the solid phase via mouse antifolate binding protein. After incubation in a reaction vessel, materials bound to the solid phase are held in a magnetic field, while unbound materials are washed away. The chemiluminescent substrate Lumi-Phos 530 is added to the vessel and light generated by the reaction is measured with a luminometer. The light production is inversely proportional to the concentration of folate in the sample. The amount of analyte in the sample is determined from a stored, multipoint calibration curve. The assay is standardized to the World Health Organization International Standard 03/178.(Beckman Coulter Assay Manual 2011, Beckman Coulter Inc., Fullerton, CA)

PDF Report
No

Day(s) Performed
Monday through Friday, Sunday

Report Available
1 to 3 days

Specimen Retention Time
14 days

Performing Laboratory Location
Mayo Clinic Jacksonville Clinical Lab

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 has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information
82746

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value

FOL	Folate, S	2284-8

Result ID	Test Result Name	Result LOINC® Value
FOL	Folate, S	2284-8