Test Definition: FAPEP

Fatty Acid Profile, Essential, Serum

Overview

Useful For

Evaluating the nutritional intake and intestinal absorption of essential fatty acids using serum specimens

Identifying deficiency of essential and other nutritionally beneficial fatty acids

Monitoring treatment of patients with essential fatty acid deficiencies who are receiving linoleic acid (C18:2w6) and alpha-linolenic acid (C18:3w3)

Method Name

Gas Chromatography Mass Spectrometry (GC-MS) Stable Isotope Dilution Analysis

NY State Available

Yes

Specimen

Specimen Type

Serum

Necessary Information

1. Patient's age is required.

2. Include information regarding treatment, family history, and tentative diagnosis.

Specimen Required

Patient Preparation:

1. Fasting:

a. **For nutritional assessment: 12 hours, required**

b. For patients with a suspected fatty acid oxidation disorder, prolonged fasting is contraindicated. Collect as close to the patient's next scheduled meal/feeding as possible.

2. Patient **must not** consume any alcohol for 24 hours before the specimen collection.

Supplies: Sarstedt Aliquot Tube, 5 mL (T914)

Collection Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Submission Container/Tube: Plastic vial

Specimen Volume: 0.5 mL

Collection Instructions: Centrifuge and aliquot serum into a plastic vial.

Specimen Minimum Volume

0.15 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	Reject
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Frozen (preferred)	92 days	
	Refrigerated	72 hours	

Clinical & Interpretive

Clinical Information

Fats are important sources of energy for tissues and for the function and integrity of cellular membranes. Deficiencies are commonly caused by inadequate dietary intake of lipids due to an unbalanced diet, long-term parenteral nutrition, or by intestinal malabsorption. Linoleic acid, an omega-6 fatty acid, and alpha-linolenic acid, an omega-3 fatty acid, are considered essential fatty acids in that they cannot be made by the body and are essential components of the diet.

The major clinical manifestations associated with essential fatty acid deficiency (EFAD) include dermatitis, increased water permeability of the skin, increased susceptibility to infection, and impaired wound healing. Biochemical abnormalities may be detected before the onset of recognizable clinical manifestations. EFAD can be detected by diminished levels of the essential fatty acids, linoleic and alpha-linolenic acid, as well as by increases in the triene:tetraene ratio.

Excess dietary fatty acids have been linked to the onset of cardiovascular disease. Elevated levels of linoleic acid can contribute to overproduction of the proinflammatory 2-series local hormones. The Academy of Nutrition and Dietetics recommends that dietary fat for the healthy adult population should provide 20% to 35% of energy, with an increased consumption of n-3 polyunsaturated fatty acids and limited intake of saturated and trans fats.(1)

Reference Values

Lauric Acid, C12:0
<1 year: 6-190 nmol/mL
1-17 years: 5-80 nmol/mL
> or =18 years: 6-90 nmol/mL

Myristic Acid, C14:0
<1 year: 30-320 nmol/mL
1-17 years: 40-290 nmol/mL
> or =18 years: 30-450 nmol/mL

Hexadecenoic Acid, C16:1w9
<1 year: 21-69 nmol/mL
1-17 years: 24-82 nmol/mL
> or =18 years: 25-105 nmol/mL

Palmitoleic Acid, C16:1w7
<1 year: 20-1,020 nmol/mL
1-17 years: 100-670 nmol/mL
> or =18 years: 110-1,130 nmol/mL

Palmitic Acid, C16:0
<1 year: 720-3,120 nmol/mL
1-17 years: 960-3,460 nmol/mL
> or =18 years: 1,480-3,730 nmol/mL

Gamma-Linolenic Acid, C18:3w6
<1 year: 6-110 nmol/mL
1-17 years: 9-130 nmol/mL
> or =18 years: 16-150 nmol/mL

Alpha-Linolenic Acid, C18:3w3
<1 year: 10-190 nmol/mL
1-17 years: 20-120 nmol/mL
> or =18 years: 50-130 nmol/mL

Linoleic Acid, C18:2w6
< or =31 days: 350-2,660 nmol/mL
32 days-11 months: 1,000-3,300 nmol/mL
1-17 years: 1,600-3,500 nmol/mL
> or =18 years: 2,270-3,850 nmol/mL

Oleic Acid, C18:1w9
<1 year: 250-3,500 nmol/mL
1-17 years: 350-3,500 nmol/mL
> or =18 years: 650-3,500 nmol/mL

Vaccenic Acid, C18:1w7
<1 year: 140-720 nmol/mL
1-17 years: 320-900 nmol/mL
> or =18 years: 280-740 nmol/mL

Stearic Acid, C18:0
<1 year: 270-1,140 nmol/mL
1-17 years: 280-1,170 nmol/mL
> or =18 years: 590-1,170 nmol/mL

EPA, C20:5w3
<1 year: 2-60 nmol/mL
1-17 years: 8-90 nmol/mL
> or =18 years: 14-100 nmol/mL

Arachidonic Acid, C20:4w6
<1 year: 110-1,110 nmol/mL
1-17 years: 350-1,030 nmol/mL
> or =18 years: 520-1,490 nmol/mL

Mead Acid, C20:3w9
< or =31 days: 8-60 nmol/mL
32 days-11 months: 3-24 nmol/mL
1-17 years: 7-30 nmol/mL
> or =18 years: 7-30 nmol/mL

Homo-Gamma-Linolenic C20:3w6
<1 year: 30-170 nmol/mL
1-17 years: 60-220 nmol/mL
> or =18 years: 50-250 nmol/mL

Arachidic Acid, C20:0
<1 year: 30-120 nmol/mL
1-17 years: 30-90 nmol/mL
> or =18 years: 50-90 nmol/mL

DHA, C22:6w3
<1 year: 10-220 nmol/mL
1-17 years: 30-160 nmol/mL
> or =18 years: 30-250 nmol/mL

DPA, C22:5w6
<1 year: 3-70 nmol/mL
1-17 years: 10-50 nmol/mL
> or =18 years: 10-70 nmol/mL

DPA, C22:5w3
<1 year: 6-110 nmol/mL
1-17 years: 30-270 nmol/mL
> or =18 years: 20-210 nmol/mL

DTA, C22:4w6
<1 year: 2-50 nmol/mL
1-17 years: 10-40 nmol/mL

> or =18 years: 10-80 nmol/mL

Docosenoic Acid, C22:1
<1 year: 2-20 nmol/mL
1-17 years: 4-13 nmol/mL
> or =18 years: 4-13 nmol/mL

Nervonic Acid, C24:1w9
<1 year: 30-150 nmol/mL
1-17 years: 50-130 nmol/mL
> or =18 years: 60-100 nmol/mL

Triene/Tetraene Ratio
< or =31 days: 0.017-0.083
32 days-17 years: 0.013-0.050
> or =18 years: 0.010-0.038

Total Saturated Acid
<1 year: 1.2-4.6 mmol/L
1-17 years: 1.4-4.9 mmol/L
> or =18 years: 2.5-5.5 mmol/L

Total Monounsaturated Acid
<1 year: 0.3-4.6 mmol/L
1-17 years: 0.5-4.4 mmol/L
> or =18 years: 1.3-5.8 mmol/L

Total Polyunsaturated Acid
<1 year: 1.1-4.9 mmol/L
1-17 years: 1.7-5.3 mmol/L
> or =18 years: 3.2-5.8 mmol/L

Total w3
<1 year: 0.0-0.4 mmol/L
1-17 years: 0.1-0.5 mmol/L
> or =18 years: 0.2-0.5 mmol/L

Total w6
<1 year: 0.9-4.4 mmol/L
1-17 years: 1.6-4.7 mmol/L
> or =18 years: 3.0-5.4 mmol/L

Total Fatty Acids
<1 year: 3.3-14.0 mmol/L
1-17 years: 4.4-14.3 mmol/L

> or =18 years: 7.3-16.8 mmol/L

Interpretation

Concentrations below the stated reference ranges are consistent with fatty acid deficiencies.

An increased triene:tetraene ratio is consistent with essential fatty acid deficiency.

Cautions

For nutritional assessment, a 12- to 14-hour fast is required; however, infants or persons suspected of having a fatty acid oxidation disorder should not fast before testing due to the possibility of acute metabolic decompensation. Instead, collect the specimen after the longest fast possible, just before feeding. In the case of a patient on total parenteral nutrition, specimen can be collected as normal.

Clinical Reference

1. Vannice G, Rasmussen H. Position of the Academy of Nutrition and Dietetics: Dietary fatty acids for healthy adults. J Acad Nutr Diet. 2014;1(114):136-153
2. Jeppesen PB, Chistensen MS, Hoy CE, Mortensen PB. Essential fatty acid deficiency in patients with severe fat malabsorption. Am J Clin Nutr. 1997;65(3):837-843
3. Spector AA, Kim HY. Discovery of essential fatty acids. J. Lipid Res. 2015;56(1):11-21
4. Luszczki E, Boakye F, Zielinska M, Deren K, et al. Vegan diet: nutritional components, implementation, and effects on adults' health. Front Nutr. 2023;10:1294497. doi:10.3389/fnut.2023.1294497

Performance

Method Description

Quantitation of fatty acids of specific chain lengths is performed as follows: a 2-step, acid-base hydrolysis is followed by hexane extraction and derivatization with pentafluorobenzyl bromide. Separation and detection are accomplished by capillary gas chromatography electron-capture negative ion-mass spectrometry. Quantitation is based on analysis in the selected ion-monitoring mode by using 13 stable isotope-labeled internal standards.(Lagerstedt SA, Hinrichs DR, Batt SM, Magera MJ, Rinaldo P, McConnell JP. Quantitative determination of plasma C8-C26 total fatty acids for the biochemical diagnosis of nutritional and metabolic disorders. Mol Genet Metab. 2001;73[1]:38-45; Gramlich L, Ireton-Jones C, Miles JM, Morrison M, Pontes-Arruda A. Essential fatty acid requirements and intravenous lipid emulsions. JPEN J Parenter Enteral Nutr. 2019;43[6]:697-707)

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available

3 to 5 days

Specimen Retention Time

2 months

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Main Campus

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

82725

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
FAPEP	Fatty Acid Profile, Essential, S	43676-6

Result ID	Test Result Name	Result LOINC® Value
17021	Lauric Acid, C12:0	35150-2
17022	Myristic Acid, C14:0	35157-7
17023	Hexadecenoic Acid, C16:1w9	35155-1
17024	Palmitoleic Acid, C16:1w7	35162-7
17025	Palmitic Acid, C16:0	35161-9
17026	g-Linolenic Acid, C18:3w6	35163-5
17027	a-Linolenic Acid, C18:3w3	35164-3
17028	Linoleic Acid, C18:2w6	35165-0
17029	Oleic Acid, C18:1w9	35166-8
17030	Vaccenic Acid, C18:1w7	35167-6
17031	Stearic Acid, C18:0	35149-4
17032	EPA, C20:5w3	35173-4
17033	Arachidonic Acid, C20:4w6	35168-4
17034	Mead Acid, C20:3w9	35172-6
17035	h-g-Linolenic, C20:3w6	35171-8
17036	Arachidic Acid, C20:0	35169-2
17037	DHA, C22:6w3	35174-2
17038	DPA, C22:5w6	35181-7

17039	DPA, C22:5w3	35180-9
17040	DTA, C22:4w6	35182-5
17041	Docosenoic Acid, C22:1	35160-1
17042	Nervonic Acid, C24:1w9	35170-0
17043	Triene Tetraene Ratio	35411-8
17044	Total Saturated Acid	35175-9
17045	Total Monounsaturated Acid	35176-7
17046	Total Polyunsaturated Acid	35177-5
17047	Total w3	35178-3
17048	Total w6	35179-1
17049	Total Fatty Acids	24461-6
17054	Interpretation	59462-2