MAYO CLINIC LABORATORIES

Test Definition: CITR

Citrate Excretion, 24 Hour, Urine

Overview

Useful For

Diagnosing risk factors for patients with calcium kidney stones

Monitoring results of therapy in patients with calcium stones or renal tubular acidosis

Special Instructions

- Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens

Method Name

Enzymatic

NY State Available

Yes

Specimen

Specimen Type

Urine

Necessary Information

Patient's age and 24-hour volume (in milliliters) are required.

Specimen Required

Patient Preparation: Any drug that causes alkalemia or acidemia may be expected to alter citrate excretion and should be avoided, if possible. The patient must avoid laxative use for 24 hour collection period.

Supplies:

-Diazolidinyl Urea (Germall) 5.0 mL (T822)

-Sarstedt 5 mL Aliquot Tube (T914)

Container/Tube: Plastic tube

Specimen Volume: 4 mL

Collection Instructions:

1. Add 5 mL of diazolidinyl urea (Germall) as preservative at start of collection **or** refrigerate specimen during and after collection.
2. Collect urine for 24 hours.
3. Mix well before taking 4-mL aliquot.

Additional Information: See Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens for multiple collections.

Forms

If not ordering electronically, complete, print, and send a Renal Diagnostics Test Request (T830) with the specimen.

Urine Preservative Collection Options

Note: The addition of preservative **must occur at the start of collection** or application of temperature controls **must occur during and after collection**

Ambient (no additive)	No
Refrigerate (no additive)	OK
Frozen (no additive)	OK
50% Acetic Acid	No
Boric Acid	OK
Diazolidinyl Urea	Preferred
6M Hydrochloric Acid	No
6M Nitric Acid	No
Sodium Carbonate	No
Toluene	No

Specimen Minimum Volume

1 mL

Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Urine	Refrigerated (preferred)	14 days	
	Frozen	14 days	

Clinical & Interpretive

Clinical Information

Urinary citrate is a major inhibitor of kidney stone formation due in part to binding of calcium in urine. Low urine citrate levels are considered a risk for kidney stone formation.

Several metabolic disorders are associated with low urine citrate. Any condition that lowers renal tubular pH or intracellular pH may decrease citrate (eg, metabolic acidosis, increased acid ingestion, hypokalemia, or hypomagnesemia).

Low urinary citrate promotes kidney stone formation and growth, and is subject to therapy by correcting acidosis, hypokalemia, or hypomagnesemia by altering diet or using drugs such as citrate and potassium.

Reference Values

0-19 years: not established

20 years: 150-1,191 mg/24 hours
21 years: 157-1,191 mg/24 hours
22 years: 164-1,191 mg/24 hours
23 years: 171-1,191 mg/24 hours
24 years: 178-1,191 mg/24 hours
25 years: 186-1,191 mg/24 hours
26 years: 193-1,191 mg/24 hours
27 years: 200-1,191 mg/24 hours
28 years: 207-1,191 mg/24 hours
29 years: 214-1,191 mg/24 hours
30 years: 221-1,191 mg/24 hours
31 years: 228-1,191 mg/24 hours
32 years: 235-1,191 mg/24 hours
33 years: 242-1,191 mg/24 hours
34 years: 250-1,191 mg/24 hours
35 years: 257-1,191 mg/24 hours
36 years: 264-1,191 mg/24 hours
37 years: 271-1,191 mg/24 hours
38 years: 278-1,191 mg/24 hours
39 years: 285-1,191 mg/24 hours
40 years: 292-1,191 mg/24 hours
41 years: 299-1,191 mg/24 hours
42 years: 306-1,191 mg/24 hours
43 years: 314-1,191 mg/24 hours
44 years: 321-1,191 mg/24 hours
45 years: 328-1,191 mg/24 hours
46 years: 335-1,191 mg/24 hours
47 years: 342-1,191 mg/24 hours
48 years: 349-1,191 mg/24 hours
49 years: 356-1,191 mg/24 hours
50 years: 363-1,191 mg/24 hours
51 years: 370-1,191 mg/24 hours
52 years: 378-1,191 mg/24 hours
53 years: 385-1,191 mg/24 hours
54 years: 392-1,191 mg/24 hours
55 years: 399-1,191 mg/24 hours
56 years: 406-1,191 mg/24 hours
57 years: 413-1,191 mg/24 hours
58 years: 420-1,191 mg/24 hours
59 years: 427-1,191 mg/24 hours
60 years: 434-1,191 mg/24 hours
>60 years: not established

Interpretation

Any value less than the mean for 24 hours represents a potential risk for kidney stone formation and growth. Patients

with low urinary citrate and new or growing stone formation, may benefit from adjustments in therapy known to increase urinary citrate excretion. (See Clinical Information)

Very low levels (<150 mg/24 hours) suggest investigation is needed for the possible diagnosis of metabolic acidosis (eg, renal tubular acidosis).

Cautions

Drugs that lower systemic pH, potassium, and/or magnesium also lower urine citrate and are to be avoided in patients with a tendency to form calcium stones.

Conversely, drugs that raise systemic pH, potassium, and/or magnesium, may raise urine citrate and should be considered when treating patients or interpreting results.

Clinical Reference

1. Hosking DH, Wilson JW, Liedtke RR, Smith LH, Wilson DM: The urinary excretion of citrate in normal persons and patients with idiopathic calcium urolithiasis. Lab Clin Med. 1985 Dec;106(6):682-689.
2. Lieske JC, Wang X: Heritable traits that contribute to nephrolithiasis. Urolithiasis. 2019 February; 47(1): 5-10
3. Lieske JC, Turner ST, Edeh SN, Smith JA, Kardia SLR: Heritability of urinary traits that contribute to nephrolithiasis. Clin J Am Soc Nephrol. 2014 May;9(5):943-950

Performance

Method Description

Citric acid in the presence of zinc (2+) at pH 8.2 is catalyzed to oxaloacetate by the enzyme, citrate lyase. Oxaloacetate in the presence of malate dehydrogenase and reduced nicotinamide adenine dinucleotide (NADH) is reduced to malate (II). The citric acid concentration in the reaction mixture can be determined by measuring the disappearance of the light-absorbing NADH. By correcting this concentration for dilution and 24-hour volume, the amount of citric acid excreted per 24 hours is obtained.(Nielsen TT: A method for enzymatic determination of citrate in serum and urine. Scand J Clin Lab Invest 1976;36:513-519; Delaney MP, Lamb EJ: Kidney disease. In: Rifai N, Horvath AR, Wittwer CT, eds. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 6th ed. Elsevier; 2018:1309-1310)

PDF Report

No

Day(s) Performed

Monday through Saturday

Report Available

Same day/1 day

Specimen Retention Time

7 days

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

82507

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
CITR	Citrate Excretion, 24 Hr, U	6687-8

Result ID	Test Result Name	Result LOINC® Value
CITRT	Citrate Excretion, 24 Hr, U	6687-8
TM51	Collection Duration	13362-9
VL49	Urine Volume	3167-4