

## Overview

### Useful For

Diagnosing risk factors for patients with calcium kidney stones using random urine specimens

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

### Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
CITR2	Citrate Concentration, Random, U	No	Yes
CRETR	Creatinine, Random, U	No	Yes
RAT10	Citrate/Creatinine Ratio	No	Yes

### Method Name

Enzymatic

### NY State Available

Yes

## Specimen

### Specimen Type

Urine

### Ordering Guidance

A timed 24-hour collection is the preferred specimen for measuring and interpreting this urinary analyte. Order CITR / Citrate Excretion, 24 Hour, Urine.

Random collections normalized to urinary creatinine may be of some clinical use in patients who cannot collect a 24-hour specimen, typically small children.

### 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 hours prior to collection.

**Supplies:** Sarstedt 5 mL Aliquot Tube (T914)

**Container/Tube:** Plastic, 5-mL tube

**Specimen Volume:** 4 mL

#### Collection Instructions:

1. Collect a random urine specimen.
2. No preservative.

**Forms**

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

**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 is subject to therapy by correcting acidosis, hypokalemia, or hypomagnesemia by altering diet or using drugs such as citrate and potassium.

**Reference Values**

No established reference values.

**Interpretation**

A low value represents a potential risk for kidney stone formation/growth. Patients with low urinary citrate and new or growing stone formation may benefit from adjustments in therapy known to increase urinary citrate excretion.

Very low citrate levels suggest investigation for the possible diagnosis of metabolic acidosis (eg, renal tubular acidosis).

For children ages 5 to 18, a ratio of less than 0.176 mg citrate/ mg creatinine is below the 5% reference range and considered low.(1)

**Cautions**

Drugs that lower systemic pH, potassium, and/or magnesium also lower urine citrate and are to be avoided in patients with 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. Srivastava T, Winston MJ, Auron A, Alon US: Urine calcium/citrate ratio in children with hypercalciuric stones. *Pediatr Res.* 2009 Jul;66(1):85-90. doi: 10.1203/PDR.0b013e3181a2939e
2. Hosking DH, Wilson JW, Liedtke RR, Smith LH, Wilson DM: The urinary excretion of citrate in normal persons and patients with idiopathic calcium urolithiasis. *J Lab Clin Med.* 1985 Dec;106(6):682-689
3. Lieske JC, Wang X: Heritable traits that contribute to nephrolithiasis. *Urolithiasis.* 2019 Feb;47(1):5-10. doi: 10.1007/s00240-018-1095-1
4. Lieske JC, Turner ST, Edeh SN, Smith JA, Kardia SL: 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 (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 to 3 days

### 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

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requirements. It has not been cleared or approved by the US Food and Drug Administration.

**CPT Code Information**

82507

82570

**LOINC® Information**

Test ID	Test Order Name	Order LOINC® Value
CITRA	Citrate Excretion, Random, U	13722-4

Result ID	Test Result Name	Result LOINC® Value
CRETR	Creatinine, Random, U	2161-8
CITR2	Citrate Concentration, Random, U	2128-7
RAT10	Citrate/Creatinine Ratio	13722-4