

Creatine Disorders Panel, Plasma

### **Overview**

### **Useful For**

Evaluating patients with a clinical suspicion of arginine: glycine amidinotransferase deficiency, guanidinoacetate methyltransferase deficiency, and creatine transporter deficiency using plasma specimens

### **Genetics Test Information**

Depletion of cerebral creatine occurs in all 3 types of creatine deficiency syndromes (CDS): arginine:glycine amidinotransferase deficiency, guanidinoacetate methyltransferase deficiency, and creatine transporter deficiency.

Measurement of guanidinoacetate, creatine, and creatinine, along with associated analyte ratios in plasma and urine, aids in distinguishing the types of creatine deficiency syndromes.

Treatment with oral creatine supplementation is effective in some types of CDS.

Creatine supplementation may impact reliability of test results.

### **Testing Algorithm**

For more information see:

- -Newborn Screen Follow-up for Guanidinoacetate Methyltransferase Deficiency
- -Epilepsy: Unexplained Refractory and/or Familial Testing Algorithm

If the patient has abnormal newborn screening results for guanidinoacetate methyltransferase deficiency, refer to the appropriate ACMG Newborn Screening ACT Sheet.(1)

### **Special Instructions**

- Biochemical Genetics Patient Information
- Newborn Screen Follow-up for Guanidinoacetate Methyltransferase Deficiency
- Epilepsy: Unexplained Refractory and/or Familial Testing Algorithm

## **Method Name**

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

#### **NY State Available**

Yes

### Specimen

## **Specimen Type**

Plasma



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### **Ordering Guidance**

For additional diagnostic testing, consider ordering CRDPU / Creatine Disorders Panel, Random, Urine.

## **Additional Testing Requirements**

To diagnose all creatine deficiency syndromes, order CRDPU / Creatine Disorders Panel, Random, Urine in addition to this test.

### **Necessary Information**

Patient's age and sex are required.

### **Specimen Required**

Collection Container/Tube:

Preferred: Lavender top (EDTA)

Acceptable: Green top (sodium heparin), yellow top (ACD)

Submission Container/Tube: Plastic vial

Specimen Volume: 0.5 mL

**Collection Instructions:** Centrifuge and aliquot plasma into plastic vial. Send plasma frozen.

#### **Forms**

- 1. <u>Biochemical Genetics Patient Information</u> (T602)
- 2. If not ordering electronically, complete, print, and send a <u>Biochemical Genetics Test Request</u> (T798) with the specimen.

### **Specimen Minimum Volume**

0.1 mL

### **Reject Due To**

Gross	ОК
hemolysis	
Gross lipemia	ОК
Gross icterus	OK

### **Specimen Stability Information**

Specimen Type	Temperature	Time	Special Container
Plasma	Frozen (preferred)	14 days	
	Ambient	72 hours	
	Refrigerated	7 days	

## Clinical & Interpretive

# **Clinical Information**

Disorders of creatine synthesis (guanidinoacetate methyltransferase [GAMT] deficiency, L-arginine:glycine amidinotransferases [AGAT] deficiency, and creatine transporter deficiency [CTD]) are collectively described as creatine



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deficiency syndromes (CDS). GAMT and AGAT deficiencies are inherited in an autosomal recessive manner, while CTD is X-linked. All 3 disorders result in a depletion of cerebral creatine and typically present with global developmental delays, especially expressive speech and language delay and intellectual disability. Affected patients may have abnormal magnetic resonance imaging findings and exhibit cerebral creatine deficiency in brain magnetic resonance spectroscopy. Patients with GAMT and male patients with CTD may develop seizures, autistic-like behaviors, and abnormal movements. Female carriers for CTD can be asymptomatic or exhibit features similar to affected male patients, such as intellectual disability, behavioral problems, and seizures.

Diagnosis of creatine synthesis disorders relies on measurement of guanidinoacetate (GAA), creatine (Cr), and creatinine (Crn) in plasma and urine. The profiles are specific for each clinical entity. In plasma, patients with GAMT deficiency typically exhibit very elevated GAA, low Cr, and normal to low Crn. Patients with AGAT deficiency typically exhibit low to normal GAA, low Cr, and normal to low Crn. Patients with CTD may have normal or abnormal plasma levels of GAA, Cr and Crn, and measurement of these analytes in urine is also useful for diagnosis in male patients (characteristic findings are elevated Cr, normal to low Crn, and an elevated Cr:Crn ratio in urine). The only consistently reliable method for diagnosis of CTD in female patients is molecular analysis of the *SLC6A8* gene. The diagnosis of GAMT, AGAT, and CTD can be confirmed by molecular analysis of *GAMT*, GATM, and *SLC6A8* respectively.

Treatment with oral supplementation of creatine monohydrate is available and effective for the AGAT and GAMT deficiencies. Patients with GAMT deficiency may also be treated with supplemental ornithine and dietary arginine restriction. CTD is treated with oral creatine monohydrate and arginine and glycine supplementation.

Early treatment has been reported to prevent disease manifestations in affected but presymptomatic newborn siblings of individuals with GAMT or AGAT deficiencies.

## **Reference Values**

#### **Creatine Disorders Panel Reference Values**

Creatine, creatinine, and guanidinoacetate results reported as nmol/mL.

	< or =11	< or =11 Months		Months	24-35 N	/lonths
	Female	Male	Female	Male	Female	Male
Creatine	38.6-96.8	39.0-97.0	38.2-96.5	38.6-96.5	37.7-96.0	38.2-96.0
Creatinine	27.6-35.9	27.6-35.2	27.6-36.5	27.6-35.5	27.6-37.1	27.6-36.0
Guanidinoacetate	0.7-2.0	0.7-2.1	0.7-2.0	0.7-2.1	0.7-2.0	0.7-2.1
Creatine/	< or =3.07	< or =3.60	< or =3.02	< or =3.54	< or =2.96	< or =3.48
creatinine						
Guanidinoacetate	< or =0.040	< or =0.040	< or =0.042	< or =0.040	< or =0.043	< or =0.042
/						
creatine						
Guanidinoacetate	< or =0.051	< or =0.081	< or =0.051	< or =0.080	< or =0.051	< or =0.079
/						
creatinine						

	3 Years		4 Ye	4 Years		5 Years	
	Female	Male	Female	Male	Female	Male	
Creatine	37.1-95.5	37.7-95.3	36.0-94.4	36.8-94.1	34.6-93.2	35.6-92.7	
Creatinine	27.6-37.9	27.7-36.9	27.6-39.3	27.7-38.2	27.6-40.9	27.8-39.9	



Guanidinoacetate	0.7-2.1	0.7-2.2	0.7-2.1	0.7-2.2	0.7-2.1	0.7-2.2
Creatine/	< or =2.89	< or =3.40	< or =2.77	< or =3.26	< or =2.64	< or =3.09
creatinine						
Guanidinoacetate	< or =0.045	< or =0.043	< or =0.049	< or =0.045	< or =0.053	< or =0.049
/						
creatine						
Guanidinoacetate	< or =0.050	< or =0.077	< or =0.050	< or =0.075	< or =0.049	< or =0.072
/						
creatinine						

	6 Ye	6 Years		ears	8 Years	
	Female	Male	Female	Male	Female	Male
Creatine	33.0-91.7	34.3-91.0	31.2-90.0	32.7-89.2	29.2-88.1	31.0-87.3
Creatinine	27.6-42.8	28.0-41.9	27.7-44.9	28.3-44.3	27.8-47.0	28.8-47.1
Guanidinoacetate	0.7-2.1	0.7-2.3	0.7-2.1	0.8-2.3	0.8-2.1	0.8-2.4
Creatine/	< or =2.49	< or =2.91	< or =2.33	< or =2.70	< or =2.17	< or =2.49
creatinine						
Guanidinoacetate	< or =0.058	< or =0.053	< or =0.063	< or =0.058	< or =0.069	< or =0.064
/						
creatine						
Guanidinoacetate	< or =0.049	< or =0.069	< or =0.048	< or =0.066	< or =0.047	< or =0.063
/						
creatinine						

	9 Y	ears	10 Y	'ears	11 Years	
	Female	Male	Female	Male	Female	Male
Creatine	27.2-85.9	29.3-85.2	25.2-83.7	27.4-83.1	23.4-81.3	25.7-80.9
Creatinine	28.0-49.3	29.5-50.1	28.2-51.5	30.6-53.6	28.4-53.6	32.0-57.2
Guanidinoacetate	0.8-2.2	0.8-2.5	0.9-2.2	0.9-2.6	0.9-2.2	1.0-2.6
Creatine/	< or =2.02	< or =2.28	< or =1.86	< or =2.07	< or =1.72	< or =1.87
creatinine						
Guanidinoacetate	< or =0.075	< or =0.070	< or =0.081	< or =0.078	< or =0.087	< or =0.085
/						
creatine						
Guanidinoacetate	< or =0.047	< or =0.060	< or =0.046	< or =0.057	< or =0.045	< or =0.055
/						
creatinine						

	12 Years		13 Years		14 Years	
	Female	Male	Female	Male	Female	Male
Creatine	21.7-78.7	23.9-78.6	20.3-76.2	22.3-76.2	19.0-73.6	20.8-73.8
Creatinine	28.7-55.7	33.8-61.0	29.1-57.7	35.9-64.8	29.5-59.5	38.1-68.5
Guanidinoacetate	0.9-2.2	1.0-2.7	1.0-2.3	1.1-2.8	1.0-2.3	1.1-2.9
Creatine/	< or =1.58	< or =1.68	< or =1.45	< or =1.50	< or =1.33	< or =1.34



creatinine						
Guanidinoacetate	< or =0.092	< or =0.093	< or =0.097	< or =0.101	< or =0.101	< or =0.109
/   creatine						
	2211	0.050		2.251		2.252
Guanidinoacetate	< or =0.044	< or =0.053	< or =0.043	< or =0.051	< or =0.042	< or =0.050
/						
creatinine						

	15 Y	'ears	16 Y	'ears	17 Y	'ears
	Female	Male	Female	Male	Female	Male
Creatine	18.1-71.1	19.5-71.2	17.4-68.7	18.4-68.6	16.9-66.5	17.4-65.9
Creatinine	29.9-61.3	40.4-71.9	30.4-62.9	42.4-75.0	30.9-64.4	44.2-77.6
Guanidinoacetate	1.0-2.3	1.2-2.9	1.1-2.3	1.3-3.0	1.1-2.3	1.3-3.1
Creatine/	< or =1.22	< or =1.20	< or =1.12	< or =1.07	< or =1.04	< or =0.97
creatinine						
Guanidinoacetate	< or =0.104	< or =0.117	< or =0.107	< or =0.125	< or =0.109	< or =0.132
/						
creatine						
Guanidinoacetate	< or =0.041	< or =0.049	< or =0.040	< or =0.048	< or =0.040	< or =0.048
/						
creatinine						

	18 \	ears/	19 Y	'ears	20 Years	
	Female	Male	Female	Male	Female	Male
Creatine	16.7-64.4	16.6-63.3	16.6-62.7	15.8-60.7	16.5-61.1	15.2-58.3
Creatinine	31.3-65.8	45.6-80.0	31.8-67.0	46.7-82.0	32.2-68.2	47.4-83.9
Guanidinoacetate	1.1-2.4	1.4-3.1	1.1-2.4	1.4-3.2	1.1-2.4	1.5-3.2
Creatine/	< or =0.98	< or =0.87	< or =0.93	< or =0.80	< or =0.89	< or =0.73
creatinine						
Guanidinoacetate	< or =0.111	< or =0.139	< or =0.112	< or =0.145	< or =0.113	< or =0.150
/						
creatine						
Guanidinoacetate	< or =0.039	< or =0.047	< or =0.038	< or =0.047	< or =0.038	< or =0.046
/						
creatinine						

	21 Y	21 Years		22 Years		'ears
	Female	Male	Female	Male	Female	Male
Creatine	16.6-59.8	14.7-56.0	16.6-58.8	14.2-54.0	16.7-57.9	13.7-52.2
Creatinine	32.5-69.2	47.9-85.6	32.8-70.2	48.2-87.2	33.1-71.1	48.4-88.8
Guanidinoacetate	1.1-2.4	1.5-3.2	1.1-2.5	1.5-3.3	1.1-2.5	1.6-3.3
Creatine/	< or =0.87	< or =0.68	< or =0.85	< or =0.64	< or =0.84	< or =0.61
creatinine						
Guanidinoacetate	< or =0.114	< or =0.156	< or =0.115	< or =0.161	< or =0.116	< or =0.165



/ creatine						
Guanidinoacetate /	< or =0.037	< or =0.045	< or =0.037	< or =0.045	< or =0.037	< or =0.044
creatinine						

	24 Years		25 Y	'ears	26 Years	
	Female	Male	Female	Male	Female	Male
Creatine	16.7-57.2	13.3-50.6	16.7-56.5	12.9-49.3	16.7-56.0	12.5-48.1
Creatinine	33.3-71.9	48.6-90.2	33.6-72.8	48.7-91.5	33.7-73.6	48.9-92.7
Guanidinoacetate	1.1-2.5	1.6-3.3	1.1-2.5	1.6-3.3	1.1-2.6	1.6-3.4
Creatine/	< or =0.84	< or =0.58	< or =0.84	< or =0.56	< or =0.84	< or =0.54
creatinine						
Guanidinoacetate	< or =0.116	< or =0.170	< or =0.117	< or =0.174	< or =0.118	< or =0.179
/						
creatine						
Guanidinoacetate	< or =0.036	< or =0.043	< or =0.036	< or =0.043	< or =0.036	< or =0.042
/						
creatinine						

	27 '	27 Years		28 Years		ears/
	Female	Male	Female	Male	Female	Male
Creatine	16.7-55.5	12.1-47.1	16.6-55.1	11.8-46.3	16.5-54.7	11.5-45.4
Creatinine	33.9-74.4	49.0-93.7	34.1-75.2	49.1-94.5	34.2-76.0	49.2-95.3
Guanidinoacetate	1.1-2.6	1.6-3.4	1.1-2.6	1.6-3.4	1.1-2.6	1.6-3.4
Creatine/	< or =0.84	< or =0.52	< or =0.84	< or =0.51	< or =0.84	< or =0.49
creatinine						
Guanidinoacetate	< or =0.118	< or =0.182	< or =0.119	< or =0.186	< or =0.119	< or =0.188
/						
creatine						
Guanidinoacetate	< or =0.036	< or =0.042	< or =0.036	< or =0.041	< or =0.036	< or =0.041
/						
creatinine						

	30 Y	30 Years		31 Years		'ears
	Female	Male	Female	Male	Female	Male
Creatine	16.4-54.2	11.3-44.7	16.4-53.8	11.1-43.9	16.3-53.4	11.0-43.2
Creatinine	34.4-76.8	49.3-96.0	34.6-77.5	49.3-96.7	34.7-78.2	49.4-97.4
Guanidinoacetate	1.2-2.7	1.6-3.5	1.2-2.7	1.6-3.5	1.2-2.7	1.6-3.5
Creatine/ creatinine	< or =0.84	< or =0.48	< or =0.83	< or =0.47	< or =0.83	< or =0.46
Guanidinoacetate / creatine	< or =0.120	< or =0.190	< or =0.120	< or =0.192	< or =0.119	< or =0.192



Guanidinoacetate	< or =0.036	< or =0.041	< or =0.036	< or =0.042	< or =0.037	< or =0.042	
/							
creatinine							

	33 Years		34 Years		35 Years	
	Female	Male	Female	Male	Female	Male
Creatine	16.3-53.0	10.9-42.5	16.4-52.7	10.8-41.7	16.4-52.3	10.7-41.0
Creatinine	34.9-78.8	49.4-98.0	35.1-79.4	49.5-98.6	35.3-79.9	49.5-99.2
Guanidinoacetate	1.2-2.8	1.6-3.5	1.2-2.8	1.6-3.5	1.2-2.8	1.6-3.4
Creatine/	< or =0.82	< or =0.45	< or =0.82	< or =0.45	< or =0.82	< or =0.44
creatinine						
Guanidinoacetate	< or =0.119	< or =0.192	< or =0.118	< or =0.191	< or =0.118	< or =0.189
/						
creatine						
Guanidinoacetate	< or =0.037	< or =0.042	< or =0.037	< or =0.042	< or =0.037	< or =0.042
/						
creatinine						

	36	<b>/</b> ears	37 Y	37 Years		'ears
	Female	Male	Female	Male	Female	Male
Creatine	16.5-52.0	10.7-40.2	16.7-51.6	10.6-39.5	16.9-51.3	10.6-38.9
Creatinine	35.4-80.3	49.5-99.8	35.6-80.7	49.5-100.3	35.8-81.0	49.6-100.8
Guanidinoacetate	1.2-2.8	1.6-3.4	1.2-2.8	1.6-3.4	1.2-2.9	1.6-3.4
Creatine/ creatinine	< or =0.82	< or =0.44	< or =0.82	< or =0.44	< or =0.83	< or =0.44
Guanidinoacetate / creatine	< or =0.117	< or =0.187	< or =0.115	< or =0.184	< or =0.114	< or =0.182
Guanidinoacetate / creatinine	< or =0.037	< or =0.042	< or =0.037	< or =0.042	< or =0.036	< or =0.042

	39 Y	39 Years		40 Years		'ears
	Female	Male	Female	Male	Female	Male
Creatine	17.1-51.1	10.6-38.2	17.3-50.9	10.7-37.7	17.5-50.8	10.7-37.2
Creatinine	35.9-81.4	49.6-101.3	36.0-81.6	49.6-101.7	36.1-81.9	49.7-102.1
Guanidinoacetate	1.2-2.9	1.6-3.4	1.2-2.9	1.6-3.4	1.2-2.9	1.6-3.4
Creatine/ creatinine	< or =0.83	< or =0.44	< or =0.83	< or =0.44	< or =0.84	< or =0.44
Guanidinoacetate / creatine	< or =0.113	< or =0.179	< or =0.111	< or =0.176	< or =0.110	< or =0.174
Guanidinoacetate /	< or =0.036	< or =0.041	< or =0.036	< or =0.041	< or =0.036	< or =0.040



creatinine				
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	42 Y	'ears	43 Y	43 Years		ears
	Female	Male	Female	Male	Female	Male
Creatine	17.7-50.8	10.8-36.7	17.8-50.8	10.9-36.3	17.8-50.9	11.0-36.0
Creatinine	36.2-82.1	49.7-102.5	36.3-82.4	49.8-102.8	36.4-82.6	49.8-103.1
Guanidinoacetate	1.2-3.0	1.6-3.3	1.2-3.0	1.6-3.3	1.2-3.0	1.6-3.3
Creatine/	< or =0.84	< or =0.44	< or =0.84	< or =0.43	< or =0.84	< or =0.43
creatinine						
Guanidinoacetate	< or =0.109	< or =0.172	< or =0.108	< or =0.171	< or =0.107	< or =0.170
/						
creatine						
Guanidinoacetate	< or =0.036	< or =0.039	< or =0.036	< or =0.039	< or =0.036	< or =0.038
/						
creatinine						

	45 Y	45 Years		'ears	47 Years	
	Female	Male	Female	Male	Female	Male
Creatine	17.7-51.0	11.1-35.6	17.6-51.2	11.2-35.3	17.4-51.4	11.3-35.1
Creatinine	36.4-82.8	49.9-103.4	36.5-83.0	49.9-103.6	36.5-83.2	49.9-103.9
Guanidinoacetate	1.2-3.0	1.7-3.3	1.2-3.1	1.7-3.3	1.2-3.1	1.7-3.3
Creatine/	< or =0.84	< or =0.42	< or =0.83	< or =0.41	< or =0.83	< or =0.40
creatinine						
Guanidinoacetate	< or =0.106	< or =0.169	< or =0.106	< or =0.168	< or =0.106	< or =0.167
/						
creatine						
Guanidinoacetate	< or =0.037	< or =0.038	< or =0.037	< or =0.037	< or =0.037	< or =0.037
/						
creatinine						

	48 \	48 Years		49 Years		'ears
	Female	Male	Female	Male	Female	Male
Creatine	17.2-51.7	11.5-34.8	17.1-51.9	11.6-34.6	17.0-52.1	11.7-34.4
Creatinine	36.6-83.4	49.9-104.1	36.6-83.5	49.9-104.2	36.7-83.7	49.9-104.4
Guanidinoacetate	1.2-3.1	1.7-3.3	1.2-3.1	1.7-3.3	1.2-3.1	1.7-3.3
Creatine/	< or =0.82	< or =0.39	< or =0.82	< or =0.38	< or =0.82	< or =0.38
creatinine						
Guanidinoacetate	< or =0.106	< or =0.166	< or =0.106	< or =0.164	< or =0.105	< or =0.163
/						
creatine						
Guanidinoacetate	< or =0.038	< or =0.036	< or =0.038	< or =0.036	< or =0.039	< or =0.036
/						
creatinine						



	51 Years		52 Years		53 Years	
	Female	Male	Female	Male	Female	Male
Creatine	17.0-52.2	11.9-34.3	17.1-52.3	12.0-34.3	17.3-52.4	12.2-34.3
Creatinine	36.8-83.9	49.8-104.6	36.8-84.0	49.8-104.8	36.9-84.2	49.8-104.9
Guanidinoacetate	1.2-3.1	1.7-3.3	1.2-3.1	1.7-3.2	1.2-3.1	1.6-3.2
Creatine/	< or =0.82	< or =0.37	< or =0.82	< or =0.37	< or =0.82	< or =0.38
creatinine						
Guanidinoacetate	< or =0.105	< or =0.161	< or =0.104	< or =0.159	< or =0.103	< or =0.157
/						
creatine						
Guanidinoacetate	< or =0.039	< or =0.036	< or =0.039	< or =0.036	< or =0.039	< or =0.036
/						
creatinine						

	54 Years		55 Y	55 Years		ears
	Female	Male	Female	Male	Female	Male
Creatine	17.6-52.5	12.4-34.3	18.1-52.6	12.5-34.4	18.6-52.7	12.6-34.4
Creatinine	37.0-84.4	49.8-105.0	37.1-84.5	49.8-105.2	37.2-84.7	49.8-105.3
Guanidinoacetate	1.2-3.1	1.6-3.2	1.2-3.1	1.6-3.2	1.2-3.1	1.6-3.2
Creatine/	< or =0.82	< or =0.38	< or =0.83	< or =0.39	< or =0.84	< or =0.40
creatinine						
Guanidinoacetate	< or =0.102	< or =0.155	< or =0.100	< or =0.154	< or =0.099	< or =0.152
/						
creatine						
Guanidinoacetate	< or =0.039	< or =0.036	< or =0.039	< or =0.036	< or =0.039	< or =0.036
/						
creatinine						

	57 Years		58 Y	58 Years		ears
	Female	Male	Female	Male	Female	Male
Creatine	19.2-52.9	12.7-34.4	19.9-53.1	12.8-34.3	20.5-53.3	12.8-34.2
Creatinine	37.3-84.9	49.8-105.4	37.4-85.1	49.8-105.5	37.6-85.2	49.8-105.6
Guanidinoacetate	1.2-3.0	1.6-3.2	1.3-3.0	1.6-3.2	1.3-3.0	1.6-3.2
Creatine/	< or =0.84	< or =0.40	< or =0.85	< or =0.41	< or =0.86	< or =0.42
creatinine						
Guanidinoacetate	< or =0.098	< or =0.151	< or =0.096	< or =0.151	< or =0.095	< or =0.150
/						
creatine						
Guanidinoacetate	< or =0.039	< or =0.036	< or =0.038	< or =0.036	< or =0.038	< or =0.036
/						
creatinine						



Creatine	21.0-53.6	12.8-34.1	21.5-53.9	12.7-34.0	21.9-54.2	12.6-33.9
Creatinine	37.8-85.4	49.9-105.7	38.0-85.5	49.9-105.9	38.3-85.7	49.9-106.0
Guanidinoacetate	1.3-2.9	1.6-3.2	1.3-2.9	1.6-3.1	1.3-2.9	1.6-3.1
Creatine/	< or =0.87	< or =0.43	< or =0.87	< or =0.44	< or =0.88	< or =0.44
creatinine						
Guanidinoacetate	< or =0.094	< or =0.150	< or =0.093	< or =0.150	< or =0.093	< or =0.150
/						
creatine						
Guanidinoacetate	< or =0.037	< or =0.036	< or =0.036	< or =0.035	< or =0.036	< or =0.035
/						
creatinine						

	63 Years		64 Y	64 Years		65 Years	
	Female	Male	Female	Male	Female	Male	
Creatine	22.2-54.6	12.4-33.7	22.3-55.0	12.3-33.6	22.5-55.5	12.2-33.4	
Creatinine	38.7-85.8	50.0-106.1	39.1-85.9	50.0-106.3	39.6-86.1	50.1-106.4	
Guanidinoacetate	1.3-2.8	1.6-3.1	1.3-2.8	1.6-3.1	1.3-2.8	1.6-3.1	
Creatine/ creatinine	< or =0.88	< or =0.45	< or =0.89	< or =0.46	< or =0.89	< or =0.46	
Guanidinoacetate / creatine	< or =0.092	< or =0.150	< or =0.092	< or =0.149	< or =0.091	< or =0.149	
Guanidinoacetate / creatinine	< or =0.035	< or =0.035	< or =0.034	< or =0.034	< or =0.034	< or =0.034	

	66 Years		67 Y	67 Years		68 Years	
	Female	Male	Female	Male	Female	Male	
Creatine	22.6-55.9	12.3-33.1	22.7-56.3	12.3-32.8	22.9-56.7	12.5-32.4	
Creatinine	40.2-86.2	50.2-106.6	40.7-86.3	50.3-106.7	41.3-86.5	50.4-106.9	
Guanidinoacetate	1.3-2.7	1.6-3.1	1.3-2.7	1.6-3.0	1.4-2.7	1.6-3.0	
Creatine/ creatinine	< or =0.90	< or =0.47	< or =0.90	< or =0.48	< or =0.90	< or =0.48	
Guanidinoacetate	< or =0.091	< or =0.149	< or =0.090	< or =0.148	< or =0.090	< or =0.148	
/	101 01031	0. 0.113	101 0.030	101 01210	101 0.030	V 01 01210	
creatine							
Guanidinoacetate	< or =0.034	< or =0.034	< or =0.033	< or =0.034	< or =0.033	< or =0.034	
/							
creatinine							

	69 Years		70 Years		> or = 71 Years	
	Female	Male	Female	Male	Female	Male
Creatine	23.2-57.0	12.8-32.0	23.6-57.2	13.1-31.4	24.1-57.3	13.6-30.8
Creatinine	41.9-86.6	50.5-107.1	42.4-86.8	50.7-107.4	42.8-86.9	50.8-107.6



Creatine Disorders Panel, Plasma

Guanidinoacetate	1.4-2.6	1.6-3.0	1.4-2.6	1.6-3.0	1.4-2.5	1.5-3.0
Creatine/	< or =0.90	< or =0.48	< or =0.90	< or =0.48	< or =0.90	< or =0.48
creatinine						
Guanidinoacetate	< or =0.090	< or =0.148	< or =0.090	< or =0.148	< or =0.090	< or =0.148
/						
creatine						
Guanidinoacetate	< or =0.033	< or =0.034	< or =0.033	< or =0.034	< or =0.033	< or =0.034
/						
creatinine						

### Interpretation

Reports include concentrations of guanidinoacetate, creatine, and creatinine, and the calculated analyte ratios. When no significant abnormalities are detected, a simple descriptive interpretation is provided. When abnormal results are detected, a detailed interpretation is given. This interpretation includes an overview of the results and their significance, a correlation to available clinical information, elements of differential diagnosis, and recommendations for additional biochemical testing.

#### **Cautions**

Creatine supplementation will cause falsely elevated creatine results and falsely decreased guanidinoacetate results.

Guanidinoacetate can be elevated in patients with urea cycle defects.

#### **Clinical Reference**

- 1. ACMG Newborn Screening ACT Sheets. Accessed December 16, 2024. Available at www.acmg.net/ACMG/Medical-Genetics-Practice-Resources/ACT\_Sheets\_and\_Algorithms/ACMG/Medical-Genetics-Practice-Resources/ACT\_Sheets\_and\_Algorithms.aspx?hkey=9d6bce5a-182e-42a6-84a5-b2d88240c508
- 2. Sanders K, Peck D, Bentz Pino G, et al. SLC6A8 creatine transporter deficiency can be detected by plasma creatine and creatinine concentrations. Mol Genet Metab. 2024;142(1):108455. doi:10.1016/j.ymgme.2024.108455
- 3. Clark JF, Cecil KM. Diagnostic methods and recommendations for the cerebral creatine deficiency syndromes. Pediatr Res. 2015;77(3):398-405
- 4. Mercimek-Mahmutoglu S, Salomons GS. Creatine deficiency syndromes. In: Adam MP, Mirzaa GM, Pagon RA, et al. eds. GeneReviews [Internet]. University of Washington, Seattle; 2009. Updated February 10, 2022. Accessed December 16, 2024. Available at www.ncbi.nlm.nih.gov/books/NBK3794/
- 5. Stockler S, Schultz PW, Salomons GS. Cerebral creatine deficiency syndromes: clinical aspects, treatment, and pathophysiology. Subcell Biochem. 2007;46:149-166
- 6. Longo N, Ardon O, Vanzo R, et al. Disorders of creatine transport and metabolism. Am J Med Genet. 2011;157:72-78. doi:10.1002/ajmg.c.30292
- 7. Fernandes-Pires G, Braissant O. Current and potential new treatment strategies for creatine deficiency syndromes. Mol Genet Metab. 2022;135(1):15-26. doi:10.1016/j.ymgme.2021.12.005

## **Performance**

## **Method Description**



Creatine Disorders Panel, Plasma

A plasma sample is combined with stable isotope-labeled internal standards and acetonitrile. After centrifugation, an aliquot of this diluted sample is analyzed by injection onto liquid chromatography columns that separate the analytes from the bulk of the stable isotope dilution in the positive electrospray selected reaction monitoring mode using the Applied Biosystems API 3200 liquid chromatography tandem mass spectrometry system with Analyst software. (Bodamer OA, Bloesch SM, Gregg AR, Stockler-Ipsiroglu S, O'Brien WEO. Analysis of guanidinoacetate and creatine by isotope dilution electroscopy tandem mass spectrometry. Clin Chim Acta. 2001;308:173-178; Cognat S, Cheillan D, Piraud M, Roos B, Jakobs C, Vianey-Saban C. Determination of guanidinoacetate and creatine in urine and plasma by liquid chromatography-tandem mass spectrometry. Clin Chem. 2004;50[8]:1459-1461; Sharer JD, Bodamer O, Longo N, Tortorelli S, Wamelink M, Young S. Laboratory diagnosis of creatine deficiency syndromes: a technical standard and guideline of the American College of Medical Genetics and Genomics. Genet Med. 2017;19[2]:256-263)

### **PDF Report**

No

# Day(s) Performed

Tuesday

## Report Available

3 to 9 days

### **Specimen Retention Time**

1 month

### **Performing Laboratory Location**

Mayo Clinic Laboratories - Rochester Main Campus

### Fees & Codes

#### **Fees**

- Authorized users can sign in to <u>Test Prices</u> for detailed fee information.
- Clients without access to Test Prices can contact <u>Customer Service</u> 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact <u>Customer Service</u>.

### **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**

82540

82565

82542

### LOINC® Information



CRDPP	Creatine Disorders Panel, P	104537-6
Result ID	Test Result Name	Result LOINC® Value
608071	Interpretation	104538-4
608072	Creatine	15045-8
608073	Creatinine	14682-9
608074	Guanidinoacetate	33244-5
608075	Creatine/Creatinine	104539-2
610624	Guanidinoacetate/Creatine	105124-2
610856	Guanidinoacetate/Creatinine	104540-0
608076	Reviewed By	18771-6