

**LABORATORY ASSESSMENT OF NUTRITIONAL STATUS:
BRIDGING THEORY & PRACTICE**

Sample pages

MAGNESIUM (Mg⁺⁺), SERUM & URINE

NORMAL VALUES, SERUM

Newborn:	1.5-2.2 mEq/L; 0.62-0.91 mmol/L (SI)
Child:	1.7-2.1 mEq/L; 0.70-0.86 mmol/L (SI)
Adult:	1.8-2.6 mEq/L; 0.74-1.07 mmol/L (SI)

CRITICAL VALUES

Hypomagnesemia:	< 1.2 mg/dL; < 0.49 mmol/L (SI)
Hypermagnesemia:	> 5.0 mg/dL; > 2.1 mmol/L (SI)

NUTRITIONAL SIGNIFICANCE

Magnesium is the second most abundant cation (after potassium) in the body. It is found in the bone (40-60 percent), muscle (20 percent), within cells (30 percent) and serum (1 percent). About half of the magnesium found in blood is free, 1/3 is bound to albumin and the balance is complexed with citrate, phosphate or other anions.

Magnesium is required for the use of ATP for energy and is involved in carbohydrate metabolism, protein synthesis, nucleic acid synthesis and contraction of muscles. In conjunction with sodium, potassium and calcium ions, it also regulates neuromuscular irritability and blood clotting. It is difficult to maintain normal potassium levels when magnesium is low.

Magnesium and calcium are intimately linked. A deficiency of either has significant effect on the metabolism of the other. Magnesium is involved in the absorption of calcium from the

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intestines and in calcium metabolism. A deficiency of magnesium will result in a drift of calcium out of the bones into soft tissues, including the aorta and kidneys.

In healthy adults, 95 percent of the magnesium is filtered through the glomerulus and reabsorbed in the tubule. With compromised kidney function, greater amounts of magnesium are retained, resulting in increased serum levels.

Magnesium deficiency may occur in individuals who are malnourished. Deficiency symptoms include weakness, irritability, tetany, electrocardiographic changes, delirium and convulsions. In magnesium deficiency, urinary magnesium declines before the serum levels. Serum magnesium levels may remain within normal ranges even when total body stores are depleted up to 20 percent. Magnesium deficiency is also related to hypocalcemia and hypokalemia. Common neurologic and GI symptoms associated with these cases include muscle tremors, muscle twitching and tetany, anorexia, nausea, vomiting, ECG abnormalities, insomnia, delirium, convulsions and hyperactive deep tendon reflexes.

Increased magnesium levels may be due to ingestion of magnesium containing antacids and exacerbated by chronic renal insufficiency or chronic renal failure. Symptoms of elevated magnesium levels include lethargy, nausea, vomiting, flushing, weak or absent deep tendon reflexes, hypotension, drowsiness, respiratory depression, slurred speech and ECG abnormalities. Specific symptoms associated with various level of hypermagnesemia are noted in Table 22.

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TABLE 22. Symptoms Associated with Hypermagnesemia

Magnesium Level (serum)	Symptoms
5.0-10.0 mg/dL; 2.1-4.1 mmol/L	CNS depression, nausea, vomiting, fatigue
10-15 mg/dL ; 4.1-6.2 mmol/L	Coma, ECG changes, respiratory paralysis
30 mg/dL ; 12.3 mmol/L	Complete heart block
34-40 mg/dL ; 14-16 mmol/L	Cardiac arrest

RELATED TESTS: kidney function tests, potassium, sodium, calcium

Serum Mg⁺⁺ Increased with:

- Renal insufficiency & failure
- Uncontrolled diabetes
- Addison's' disease
- Hypothyroidism
- Dehydration
- Antacids containing Mg⁺⁺
- Oliguria

Serum Mg⁺⁺ Decreased with:

- PEM
- Malabsorption
- Hypoparathyroidism
- Alcoholism
- Chronic renal disease
- Diabetic acidosis
- Hypercalcemia
- Chronic pancreatitis
- Hyperaldosteronism
- Long term TPN
- SIADH
- Pregnancy (2nd,3rd trimester)
- Excessive loss of body fluids
 - diaphoresis
 - lactation
 - diuretic abuse
 - chronic diarrhea

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Medications that may increase serum levels:

Alkaline antacids	Amiloride	Aminoglycoside antibiotics
Antacids	Aspirin	Calcitriol
Cefotaxime	Felodipine	Hydroflumethiazide
Lithium	Loop diuretics	Magnesium salts
Medroxyprogesterone	Progesterone	Sodium bicarbonate
Tacrolimus	Thyroid medications	Triamterene

Medications that may decrease serum levels:

Albuterol	Aldesleukin	Amphotericin B
Arsenic trioxide	Azathioprine	Basiliximab
Calcitriol	Calcium gluconate	Cefotaxime
Chlorothiazide	Chlorthalidone	Cisplatin
Cyclosporine	Digoxin	Doxorubicin
Ethacrynic acid	Foscarnet	Furosemide
Gentamicin	Haloperidol	Hydrochlorothiazide
Hydroflumethiazide	Insulin	Metolazone
Neomycin	Oral contraceptives	Pamidronate
Pentamidine	Prednisolone	Sirolimus
Tacrolimus	Theophylline	Thiazides
Tobramycin	Trastuzumab	Voriconazole
Zalcitabine	Zoledronic acid	

Medications that may increase urine levels:

Acetazolamide	Ammonia chloride	Amphotericin B
Bumetanide	Calcitonin	Chlorothiazide
Cisplatin	Cyclosporin A	Ethacrynic
Furosemide	Gentamicin	Hydrochlorothiazide
Lithium	Magnesium hydroxide	Methyclothiazide
Thiazides	Torsemide	Triamterene

Medications that may decrease urine levels:

Acetazolamide	Amiloride	Calcium gluconate
Interferon α -2a	Oral contraceptives	Parathyroid extract