

Magnesium - A Metal Essential to Life

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Magnesium is the ninth most abundant element in the universe, the eighth most abundant element in the earth's crust, the fourth most common element in the earth and the third most abundant element dissolved in seawater.¹⁻³

Magnesium is the eleventh most abundant element by mass in the human body and is essential to some 300 enzymes. An adult body contains approximately 25 g magnesium, with 50% to 60% present in the bones and most of the rest in soft tissues.⁴ Adenosine triphosphate (ATP), the primary energy source for cells, must be bound to magnesium to be biologically active. The synthesis of DNA and RNA requires the presence of magnesium for catalytic action.

The interaction of magnesium with enzymes can either alter the shape of an enzyme or take part in the chemistry of the enzymatic reaction itself. Magnesium is a Lewis acid that can facilitate hydrolysis and condensation reactions (e.g. phos-

phate ester hydrolysis and phosphoryl transfer) that would not normally occur at physiological pH values.^{5,6} The binding of magnesium to DNA and RNA stabilizes their structure, and many enzymes involved in nucleic acid synthesis bind magnesium for both activation and catalysis. Magnesium also stabilizes cell membranes by binding to the lipids comprising them, thus regulating transport across the membrane.

Inadequate magnesium in the diet can cause weakness and muscle spasms in addition to being associated with cardiovascular disease and high blood pressure, migraines, anxiety disorder, osteoporosis and cerebral infarction.^{7,8} Excess magnesium is not normally a problem in adults, as too much magnesium will cause diarrhea and magnesium is efficiently excreted by the renal system. However, infants lack this efficiency so should not be given magnesium supplements except when under a physician's care.

Assessing magnesium status is difficult because most magnesium is inside cells or in bone. The most commonly used and readily available method for assessing

magnesium status is measurement of serum magnesium concentration, even though serum levels have little correlation with total body magnesium levels or concentrations in specific tissues. Other methods for assessing magnesium status include measuring magnesium concentrations in erythrocytes, saliva, and urine; measuring ionized magnesium concentrations in blood, plasma, or serum; and conducting a magnesium-loading (or "tolerance") test. No single method is considered satisfactory.⁹

Magnesium may be measured in the laboratory by various gravimetric, titrimetric, electrochemical, spectrophotometric and mass spectrometric techniques, but is most easily analyzed by complexation followed by spectrophotometry. The most commonly-used reagent for spectrophotometry of magnesium is xylydyl blue, which forms a red complex and is measured at 530 nanometers (green light) in the visible spectrum. A complexing agent and detergents are added to inhibit interference from calcium and proteins in solution.¹⁰ This is a rapid, easily-automated analysis.

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The SAMHSA Office of Behavioral Health Equity (OBHE) works to reduce mental health and substance use disparities among diverse racial and ethnic populations, as well as lesbian, gay, bisexual, and transgender (LGBT) populations. OBHE was established to improve access to quality care and in accordance with section 10334(b) of the Affordable Care Act of 2010, which requires six agencies under the Department of Health and Human Services (HHS) to establish an office of minority affairs.

Source: SAMHSA

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Question of the Month

Question: *What is a Sodium Fluoride tablet used for? When should it be used?*

Answer: A person with diabetes (either diagnosed or undiagnosed), who is not properly controlling their condition, can 'spill' sugar into their urine. Post void, the sugars in the urine can convert into alcohol via fermentation. If this occurs, and there is a test for alcohol on the drug screen, it is highly likely that a Positive result for alcohol will be found. A Sodium Fluoride tablet, when placed in the urine sample immediately post void (within a few minutes), will inhibit the fermentation, and therefore prevent a Positive result for alcohol due to the diabetic condition.

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