

Recently Published Article from a Physician Who Uses the EXAtest

Magnesium: Importance and Measurement

Sun Article, March 1999

Richard Gracer, M.D.

My interest in nutritional medicine has been active and growing for many years. Once in a while, I find a new technology, which really makes a difference in my clinical practice. Several weeks ago, at a nutritional medicine conference, I evaluated a new way of testing for important minerals inside the cells. The usual blood tests look at the level of electrolytes in the blood. These levels are inexpensive and easy to test. The blood serum levels of potassium, sodium, chloride, and carbon dioxide are very important for helping physicians determine what types of IV fluids or other medications are needed to maintain proper electrolyte balance. For example, potassium is very often depleted by diuretics, which are often used in the treatment of heart failure or hypertension. Serum sodium may be low with liver disease or overuse of diuretics.

Another mineral, magnesium, can also be measured in the blood serum. However, almost all of the magnesium in the body is inside the cells. Approximately 60 percent is in bone, 26 percent in muscle, and the rest in soft tissue. It is most important in the most metabolically active and important organs such as the liver and kidney, brain and muscles, including the heart.

Only a very small amount of magnesium is dissolved in the blood, and therefore magnesium blood levels are misleading and clinically almost useless. Potassium is also found mostly in the cells. It is tied to the main electrolyte found in the blood, sodium, and therefore the potassium serum level is very important and clinically useful. The amount of potassium inside the cells is also important, but is much more difficult to measure. Just as potassium and sodium are metabolically linked, magnesium and calcium inside the cell have a reciprocal arrangement. Magnesium belongs inside the cells; almost all the calcium belongs outside.

Magnesium plays a critical role in energy production. It is a vital part of more than 300 cellular processes; many of the most important of these are found in the mitochondria, the energy production units in our cells. Magnesium is vital for the "pumps" that keep sodium and calcium out of the cell, retaining the magnesium and potassium. When calcium and sodium "leak" into the cells, and there is not enough magnesium and

potassium, these enzymes work less efficiently and energy production decreases. This manifests most seriously in the heart, blood vessels, kidneys and liver.

Magnesium deficiency is very common in our society, especially in the elderly. This may be because of inadequate intake or reduced ability to absorb the mineral from the intestines. Increased magnesium loss in the urine can result from alcohol, diuretics, liver or kidney disease or too much calcium in the diet (Magnesium should always be taken along with calcium supplements.).

Low intracellular (in the cells) magnesium is associated with heart disease, hypertension, kidney stones, menstrual cramps, chronic diarrhea, muscle cramps, migraine headaches, diabetes, chronic fatigue and fibromyalgia, and asthma.

Symptoms of low magnesium include fatigue, irritability, weakness, irregular heartbeat, nerve conduction problems, insomnia, stress, and decreased appetite.

The daily requirement for magnesium is 350 milligrams daily. High levels of magnesium are found in nuts, wheat bran and wheat germ, and soybeans, molasses, and to a lesser extent in beets, sweet potato, beans and other green vegetables. Milk has only low levels of magnesium. Most Americans do not get adequate magnesium as part of their daily diet. It is therefore important to take supplemental magnesium if you are in a higher risk group, or have low intracellular magnesium levels. Women who are taking extra calcium for prevention or treatment of osteoporosis also must take magnesium in a ratio of two parts calcium to one part magnesium.

Magnesium is available in many different varieties. The best absorbed and most easily used by the body are magnesium (often mixed with potassium) malate, aspartate, succinate, and citrate. These compounds, called intermediaries, are part of the critical cellular energy producing reactions, known as the Krebs cycle. There is evidence that minerals that are "chelated" to these compounds are more easily absorbed into the body from the intestines and are brought directly into the cells than the inorganic forms of magnesium, such as magnesium oxide. There is most likely less diarrhea and other side effects with these forms as well. The Krebs intermediaries, especially in the form of potassium-magnesium aspartate, can decrease fatigue themselves in many cases.

Most people can easily replenish their magnesium stores with these oral supplements. Many others, however, cannot correct chronically low magnesium levels. They may need IV infusions of minerals and vitamins to regain proper balance. IV magnesium is used in the acute treatment of heart attacks and irregular heart rhythms, asthma, migraine headaches, and toxemia of pregnancy.

In the past we have measured the magnesium content inside red blood cells (RBC's). These are easy to sample by just taking a tube of blood. RBC's are not typical cells and therefore may not reflect the level of magnesium in active normal cells. They are produced in the bone marrow and then live approximately 120 days, eventually to be eliminated in the liver and spleen. A better cell type that is easily obtained can

be found in the floor of the mouth. A small painless scraping of the cells is placed on a slide. The cells are preserved in the same way as a Pap smear.

The cells are then placed under electron microscope, which spectrographically determines the exact amount of magnesium, calcium, potassium, sodium, and chloride in the cells. The tissue scraping is easily done in any physician's office. These levels are accurate and correlate very well in both human and animal studies to clinical situations in which the intracellular magnesium level is important. This test called the Exatest is performed by Intracellular Diagnostics. (www.exatest.com)

I have been using this test with great success in my patients who I suspect have low intracellular magnesium levels. These include those with migraine headaches, asthma, GI problems, heart failure, those taking diuretics, chronic fatigue and muscle aches, as well as those who may have malnutrition and other vitamin deficiencies. This has allowed me to prescribe more accurate treatment and has resulted in better clinical results.

Remember that serum magnesium levels are not reflective of true magnesium status and therefore a normal serum magnesium level has little clinical relevance. In general, those with low serum potassium levels almost always need extra magnesium as well. If you take potassium along with a diuretic, unless you have serious kidney problems, you probably need extra magnesium. If you take calcium supplements for prevention or treatment of osteoporosis, take magnesium, along with zinc and other trace minerals also. These minerals, as well as calcium, are important for bone health and maintenance. They are inexpensive and taking them really pays off.



Go to the Top of the Page