

## Magnesium

### AT A GLANCE

#### Introduction

Magnesium (Mg) is essential to all living cells. The earth metal plays important roles in the structure and the function of the human body.

The adult human body contains about 25 grams of magnesium. Over 60% of all the magnesium in the body is found in the skeleton, about 27% is found in muscle.

Magnesium is involved in more than 300 essential metabolic reactions.

#### Health Functions

A sufficient intake of magnesium is important as it helps the body to

- use carbohydrates and fats for energy generation
- conduct nerve impulses, muscle contraction, and normal heart rhythm
- regulate calcium, copper, zinc, potassium, and vitamin D levels.

The European Food Safety Authority (EFSA), which provides scientific advice to assist policy makers, has confirmed that clear health benefits have been established for the dietary intake of magnesium in contributing to:

- electrolyte balance;
- normal energy-yielding metabolism;
- normal muscle function including the heart muscle;
- normal nerve function;
- normal cell division;
- the maintenance of normal bone;
- the maintenance of normal teeth;
- normal protein synthesis.

#### Disease Risk Reduction

##### **High blood pressure**

Eating low-fat dairy products along with lots of fruits and vegetables on a regular basis is associated with lower blood pressure. All of these foods are rich in magnesium as well as calcium and potassium. Singling out which of these nutrients is responsible for lowering blood pressure is difficult.

A large clinical study found that a higher intake of dietary magnesium may decrease the development of high blood pressure in women.

## **Heart disease**

One large study found a trend for increasing blood magnesium levels to be associated with decreased risk of heart disease in women but not in men. However, the risk of heart disease in the group with the lowest intake of dietary magnesium intake was not significantly higher than the risk in men or women with the highest intake.

Presently, the relationship between dietary magnesium intake and the risk of heart disease remains unclear.

## **Other Applications**

*Please note:*

*Any dietary or drug treatment with high-dose micronutrients needs medical supervision.*

## **High blood pressure**

Results of clinical studies using magnesium supplements to treat abnormally high blood pressure ('hypertension') have been conflicting. Long-term clinical trials are needed to determine whether magnesium has any therapeutic benefit in hypertensive individuals.

## **Heart disease**

Magnesium is essential to heart health. This mineral is particularly important for maintaining a normal heart rhythm and is often used by physicians to treat irregular heartbeat ('arrhythmia'), especially in people with congestive heart failure, who are often at particular risk for developing an arrhythmia.

Results of studies using magnesium to treat heart attack survivors, however, have been inconsistent. While some studies have reported reduced death rates as well as fewer arrhythmias and improved blood pressure when magnesium is used as part of the treatment following a heart attack, other studies did not show such effects.

## **Stroke**

Results from population studies suggest that people with low magnesium in their diet may be at greater risk of stroke.

Some preliminary clinical evidence suggests that magnesium sulfate may be helpful in the treatment of a stroke or a temporary disturbance of blood supply to an area of the brain ('transient ischemic attack', TIA).

## **Preeclampsia**

Preeclampsia is a condition characterized by a sharp rise in blood pressure during the third trimester of pregnancy. Women with preeclampsia may develop seizures, which is then called eclampsia.

Magnesium administered in the hospital intravenously (IV or into the veins) is the treatment of choice to prevent or treat seizures associated with eclampsia.

### **Diabetes**

Type 2 diabetes is associated with low levels of magnesium in the blood. A large clinical study found that higher dietary intake of magnesium may protect against development of type 2 diabetes. Magnesium was found to improve insulin sensitivity in these people, reducing the risk of developing type 2 diabetes.

Other clinical studies have found similar results, especially in the elderly.

Magnesium deficiency in diabetic patients may decrease their immunity, making them more susceptible to infections and illnesses.

### **Osteoporosis**

Calcium, vitamin D, magnesium, and other micronutrient deficiencies are believed to play a role in the development of osteoporosis.

Adequate intake of calcium, magnesium, and vitamin D coupled with overall proper nutrition and weightbearing exercise throughout childhood and adulthood are the primary preventive measures for this condition in both men and women.

### **Migraine headache**

Magnesium levels tend to be lower in those with migraine headaches, including children and teenagers, when compared to those with tension headaches or no headaches at all.

In addition, a few clinical studies suggest that magnesium supplements may decrease migraine duration and reduce the amount of medication needed.

Some experts suggest that oral magnesium may be an appropriate alternative to prescription medication for people who suffer from migraine headaches. Magnesium supplements may prove to be a welcome option for migraine sufferers who cannot tolerate medications due to side effects or who cannot take migraine medications due to pregnancy or heart disease.

Further studies are needed to evaluate the significance of magnesium supplements as an alternative for migraine medications.

### **Asthma**

A population study found that low dietary magnesium intake may be associated with a risk of developing asthma in children and adults.

In addition, some clinical studies suggest that intravenous and inhaled magnesium can help treat acute asthma attacks in children as well as adults. Evidence from other clinical studies report that long-term oral magnesium supplementation does not lead to improved control in adult asthma.

### **Attention deficit/hyperactivity disorder (ADHD)**

Some experts believe that children with attention deficit/hyperactivity disorder (ADHD) may be exhibiting the effects of mild magnesium deficiency, such as irritability, decreased attention span, and mental confusion. In one clinical study, 95% of the children with ADHD were magnesium deficient.

In another clinical study, children with ADHD who received magnesium demonstrated a significant improvement in behavior, whereas those who received only standard therapy without magnesium exhibited worsening behavior.

These results suggest that magnesium supplementation may prove to be beneficial for children with ADHD.

### **Infertility and miscarriage**

A small clinical study of infertile women as well as women with a history of miscarriage found that low levels of magnesium may impair reproductive function and increase the risk of miscarriage.

It has been suggested that one aspect of infertility treatment should include magnesium and selenium.

### **Premenstrual syndrome (PMS)**

Scientific evidence and clinical experience suggest that magnesium supplements may help relieve symptoms associated with PMS, particularly bloating, insomnia, leg swelling, weight gain, and breast tenderness.

Preliminary information suggests that magnesium may also be helpful for alleviating mood swings.

### **Intake Recommendations**

European health authorities have determined for magnesium an acceptable range of intake for adults of 150–500 mg per day.

In the U.S., the recommended magnesium intakes have been set at 400–420 mg for males and 310–320 mg for females.

### **Supply Situation**

Nutrition surveys have indicated that estimated average magnesium intakes in many European countries and the U.S. are below the recommended intakes.

## Deficiency

Despite the fact that dietary levels of magnesium are often low, actual deficiency of this nutrient is rare. Certain medical conditions, however, can upset the body's magnesium balance. For example, intestinal flu with vomiting or diarrhea can cause temporary magnesium deficiencies. Certain stomach and bowel diseases, diabetes, pancreatitis, kidney malfunction, and use of diuretics can lead to deficiencies.

Too much coffee, soda, salt, or alcohol intake as well as heavy menstrual periods, excessive sweating, and prolonged stress can also lower magnesium levels.

Symptoms of magnesium deficiency may include agitation and anxiety, restless leg syndrome (RLS), sleep disorders, irritability, nausea and vomiting, abnormal heart rhythms, low blood pressure, confusion, muscle spasm and weakness, hyperventilation, insomnia, poor nail growth, and even seizures.

## Sources

Rich sources of magnesium include tofu, legumes, whole grains, green leafy vegetables, wheat bran, soybean flour, almonds, cashews, blackstrap molasses, pumpkin and squash seeds, pine nuts, and black walnuts.

Green leafy vegetables are particularly good sources of magnesium because they contain high levels of chlorophyll, in which magnesium is the central atom.

Other good dietary sources of this mineral include peanuts, whole wheat flour, oat flour, beet greens, spinach, pistachio nuts, shredded wheat, bran cereals, oatmeal, bananas, and baked potatoes (with skin), chocolate, and cocoa powder.

## Safety

Adverse effects (e.g. diarrhea) from excess magnesium have been observed with intakes of supplemental magnesium.

Individuals with impaired kidney function are at higher risk for adverse effects of magnesium supplementation.

Elevated blood levels of magnesium ('hypermagnesemia') may result in a fall in blood pressure ('hypotension'). Some of the later effects of magnesium toxicity, such as lethargy, confusion, disturbances in normal cardiac rhythm, and deterioration of kidney function, are related to severe hypotension. As hypermagnesemia progresses, muscle weakness and difficulty breathing may occur.

## Tolerable upper intake level

While European health authorities have established a tolerable upper intake level for magnesium intake of 250 mg/day for adults, a value of 350 mg/day has been set in the U.S.

## Drug interactions

*Please note:*

*Because of the potential for interactions, dietary supplements should not be taken with medication without first talking to an experienced healthcare provider.*

Authored by Dr Peter Engel in 2010 and reviewed and revised by Angelika Friedel on 22.05.2017.