Lack Energy? Maybe It's Your Magnesium Level

Most people think of calcium and phosphorus as the most important dietary components for bone health. But magnesium also plays an important role. It is involved in hundreds of biochemical reactions, many of which help keep not only bones strong, but the heart rhythm healthy and the nervous system functioning smoothly.

A study by ARS physiologist Henry C. Lukaski and nutritionist Forrest H. Nielsen reveals important findings on the effects of depleted body magnesium levels on energy metabolism. Lukaski is assistant director of ARS’s Grand Forks Human Nutrition Research Center, Grand Forks, North Dakota. He and Nielsen, with the center’s clinical nutrition support staff, showed that inadequate magnesium is associated with a need for increased oxygen during exercise. They found that during moderate activity, those with low magnesium levels in muscle are likely to use more energy—and therefore to tire more quickly—than those with adequate levels.

The study’s first phase provided 10 postmenopausal women with a controlled diet adequate in magnesium for 35 days. In the next phase, a low-magnesium diet provided less than half the recommended daily intake for 93 days. The last phase provided a diet adequate in magnesium for 49 days. The volunteers were subjected to exercise tests at the end of each dietary phase, along with biochemical and physiological tests.

After consuming the low-magnesium diet, volunteers showed a significant overall loss of magnesium. They had lowered muscle levels of magnesium, and their red blood cells were at the low end of the normal range.

Too little magnesium in your diet will make your body work harder. Good sources of magnesium include bran muffins, pumpkin seeds, barley, buckwheat flour, low-fat vanilla yogurt, trail mix, halibut steaks, garbanzo beans, lima beans, soybeans, and spinach.
The data shows that during the low-
magnesium-status phase, the volunteers
used more oxygen during physical ac-
tivity, and their heart rates increased by
about 10 beats per minute. “When the
volunteers were low in magnesium, they
needed more energy and more oxygen
to do low-level activities than when they
were in adequate-magnesium status,”
says Lukaski.

The study was published in the May
The body stores about half its mag-
nesium inside the cells of tissues and
organs. The other half is combined with
calcium and phosphorus inside bones. A
tiny amount—just 1 percent—of the
body’s magnesium circulates within the
blood at a constant level.

These findings are consistent with
other studies showing that too little mag-
nesium makes the body work harder.
“The effects are likely to occur in indi-
viduals with low magnesium, regardless
of whether the person is athletic or sed-
entary,” says Lukaski. “That means
that athletes wouldn’t be able to work or train
as long as they would if they had better
magnesium levels. People need to eat ade-
quate magnesium to make sure their
hearts and muscles are healthy enough
to meet the demands of daily living.”

The Recommended Dietary Allow-
ance (RDA) for magnesium, based on the
current Dietary Reference Intakes (DRIs),
for women over age 31 is 320 milligrams (mg)
daily and for men over
age 31 is 420 mg daily. The DRIs are a
set of categories of nutrient requirements
by age and/or gender groupings that are
released as an authoritative, ongoing
series by the National Academy of
Sciences. Starting in 1941, RDAs were
updated periodically as a separate group
to reflect current scientific knowledge.
Now, RDAs appear as one of several
categories that together make up the
more detailed DRIs. ARS provides key
data for use by experts who help establish
the DRIs.

Another study at the Grand Forks
center, headed by physician Leslie M.
Klevay, with biochemist David B. Milne,
found an association between ordinary
diets low in magnesium and irregular
heartbeats. Klevay heads the center’s
Trace Elements and Cardiovascular
Health Laboratory. The study provided
22 postmenopausal women, aged 47 to
78, with a diet of conventional foods
containing either less than half or more
than the RDA for magnesium of 320 mg
daily. All volunteers ate both controlled
diets—each for 81 days—throughout the
study, though they were not told which
diet was given first.

After each 81-day diet phase, magne-
sium concentrations were measured
through blood tests. The scient-
ists also wanted to evaluate the
characteristics of electrical impulses
that provide pumping instructions to the heart. Electro-
cardiograms were taken at the
end of each phase to measure
volunteers’ heart rhythms.

When the women ate a diet
containing just 40 percent of the
RDA for magnesium, they
showed signs of magnesium deple-
tion in their blood serum, red
blood cells, and urine. At the
same time, they experienced
small increases in heartbeats
that arise in abnormal areas
within the heart, which are called ectopic heart-
beats. They indicate increased myocardial
irritability.

“These changes indicate that 130 mg
of magnesium is too little and that the
RDA may be correct,” says Klevay. “People
who live in soft-water areas, who use
diuretics, or who are predisposed to
magnesium loss or ectopic beats may
require more dietary magnesium than
would others.”

Perhaps not surprisingly, people who
live in areas where the water is hard—
and therefore contains more minerals, in-
cluding magnesium—have been found to
have a reduced risk for heart disease.
Magnesium is sometimes provided intra-
vously to people shortly after they’ve
had a heart attack, though at least one
study showed no evidence of a “survival
benefit” from the practice.

Klevay’s study was published in the
March 2002 issue of the American Jour-
nal of Clinical Nutrition.

Data from the nationwide food con-
sumption survey, the USDA-ARS Con-
tinuing Survey of Food Intakes by
Individuals (CSFII 1994-96), indicate
that only about 24 percent of women
between ages 40 and 69 were meeting
the 1989 RDA for magnesium. The
current RDA-DRI for magnesium is 40
mg higher than the 1989 RDA for that
age group.

In addition, the ARS Community Nu-
trition Research Group (CNRG) reports
data from its online Com-
munity Nutrition Map (CNMap)
indicating that only about 32 percent of
the U.S. population met
the RDA-DRI for magne-
sium. The CNRG is one
of six laboratories in the
Beltsville (Maryland)
Human Nutrition Re-
search Center. The map-
ning project combines a
collection of food-and-
nutrition-consumption
indicators (obtained from
several sources, includ-
ing CSFII 1994-96) with
Geographic Information System software. This data provides a snapshot of
the percentage of people meeting
the requirements for different nutrients.
CNMap can be accessed at www.barc.
usda.gov/bhnrc/cnr/cnmmapfr.htm.—By
Rosalie Marion Bliss, ARS.

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tion, an ARS National Program (#107)
described on the World Wide Web at
www.nps.ars.usda.gov.

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