

Unique Longevity Benefits of MAGNESIUM

BY ELIZABETH EMORY

Calorie restriction is one of the most effective interventions that reliably slows aging and extends lifespans in numerous species. The problem is that it requires severe reductions in food intake that are nearly impossible for most people to follow.^{1,2}

Fortunately, it may be possible to achieve many of the benefits of calorie restriction *without limiting your food intake*.

A cell study published in late **2016** revealed that **magnesium supplementation** mimics a key underlying mechanism of calorie restriction.¹

That study showed that magnesium reduces or eliminates structures called **R-loops**. These structures are extremely harmful because they contribute to an **unstable genome**.¹ Since unstable genomes lead to cell death and raise cancer risk, stabilizing the cellular genome by eliminating R-loops can powerfully prevent disease and promote longevity.³⁻⁶

This latest study on magnesium represents a remarkable advance in the ability to replicate the benefits of calorie restriction on health and longevity—without limiting caloric intake.



What Are R-loops?

To understand the new study on magnesium, it's necessary to understand the concept of **R-loops** and why preventing their formation is essential for preventing disease and extending lifespan.

R-loops are structures that form when strands of DNA and RNA interfere with each other, causing one strand of DNA to **bulge** away from the main strand, forming a loop.^{1,3,7,8} That lone DNA strand is highly vulnerable to damage and mutation.^{4,5,7}

Compounding the problem, bulging R-loops interfere with the repair of damaged DNA.⁹

The result of these disruptions is an **unstable genome**, meaning one likely to undergo dangerous mutations. The end result is either **premature cell death** (and consequently loss of tissue function) or **out-of-control cell replication** (and consequently cancer formation).^{4,5,7,8}

R-loop accumulation has been linked to numerous diseases, such as cancers of the breast, ovary, and

colon, as well as neurodegenerative diseases such as amyotrophic lateral sclerosis (ALS).^{5,7}

Add to this the known harmful effects of genomic instability on **longevity** in general, and it's easy to see the tremendous importance of finding ways to suppress the formation of R-loops in human cells.^{7,10,11} That's what makes this new magnesium study so exciting.

The Magnesium Connection

Scientists have known for years that calorie restriction promotes **genomic stability** by decreasing the accumulation of R-loops.¹ What they didn't know was *how*. The answer is that calorie restriction increases the amount of **magnesium** in the cells.

The researchers first saw this when calorie-restricted yeast cells began accumulating magnesium ions. This occurred as a result of boosted production of specialized **magnesium transporter complexes**, which pull magnesium into cells.¹

Next, they found that having a higher concentration of magnesium in the cells powerfully repressed the formation of R-loops. This suggested that magnesium is the link between calorie restriction and R-loop suppression.¹

They then showed that disrupting the magnesium transporters—or taking magnesium out of the cells' growth medium—*prevented* the calorie-restriction benefit of suppressing R-loop formation.

Together, these findings **confirmed** that magnesium is indeed the connection between calorie restriction and R-loop suppression.¹

So the important question is: If raising intracellular magnesium is the mechanism by which calorie restriction represses R-loops, is it possible to accomplish this by magnesium supplementation alone? Once again, the encouraging answer is *yes*.

Achieving the Benefits of Calorie Restriction

A series of experiments showed that magnesium significantly prevented R-loop buildup *completely independent of calorie restriction*.¹

In yeast cells, magnesium supplementation significantly decreased R-loop accumulation by **47%** to **68%**. Even more exciting, it accomplished this entirely without inducing any DNA damage and, in fact, helped to **stabilize** the genome.¹

Studies in human cells revealed several promising effects of magnesium supplementation.

First, as in the yeast cells, magnesium produced calorie restriction-like reductions in R-loop formation. Two additional findings showed how magnesium's ability to reduce R-loops could have a beneficial impact on ALS and cancer.

As we saw earlier, ALS is linked to R-loop accumulation. This study showed that cells from patients with ALS were found to carry **mutations** that impair activity of the important **magnesium transporters** that pull magnesium into cells.¹ This finding may indicate that ALS—and perhaps related conditions—arise from an inability to suppress R-loops through the magnesium-dependent mechanism.

Perhaps most excitingly, this study found that magnesium's impact on R-loops could help prevent cancer. Healthy cells contain a cancer-suppressor protein called **BRCA2**, which naturally suppresses R-loop formation. But when there are mutations in **BRCA2**, it can no longer block R-loop formation, which opens the door for cancers to form. This study showed that magnesium could **rescue** cancer-prone cells that were deficient in the cancer-suppressor protein BRCA2.¹

The science behind all of this is very complicated, but the bottom line is this: In cells, supplementation with magnesium—entirely in the absence of calorie restriction—produced the R-loop suppression

that is one of the primary cellular mechanisms by which calorie restriction acts.

In other words, magnesium supplementation may be one way to mimic calorie restriction to obtain its benefits without severe compromise to lifestyle.

Summary

Calorie restriction is one of the most effective interventions that reliably increases lifespan in life forms ranging from microscopic, single-celled organisms to complex mammals. But because calorie restriction requires severe reductions in food intake, most humans find it nearly impossible to follow.

A compelling new study has identified magnesium supplementation as a unique way to mimic one of the known cellular effects of calorie restriction, namely, suppression of genome-destabilizing **R-loops**.

Doing so helps cells stabilize the genetic structure, which is an important part of preventing disease and increasing longevity.

This discovery places magnesium in the same potential life-extending category with other nutrients known to mimic individual effects of calorie restriction. ●

If you have any questions on the scientific content of this article, please call a Life Extension® Wellness Specialist at 1-866-864-3027.

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