Cognitive Vitality Reports® are reports written by neuroscientists at the Alzheimer's Drug Discovery Foundation (ADDF). These scientific reports include analysis of drugs, drugs-in-development, drug targets, supplements, nutraceuticals, food/drink, non-pharmacologic interventions, and risk factors. Neuroscientists evaluate the potential benefit (or harm) for brain health, as well as for age-related health concerns that can affect brain health (e.g., cardiovascular diseases, cancers, diabetes/metabolic syndrome). In addition, these reports include evaluation of safety data, from clinical trials if available, and from preclinical models.

Magnesium

Evidence Summary

Observational studies suggest that having adequate levels of magnesium is associated with a lower risk of dementia as well as several age-related diseases.

Neuroprotective Benefit: Observational data suggests that having sufficient levels of circulating magnesium or higher intake of magnesium is associated with a lower incidence of dementia. It is not clear whether there is a benefit outside of treating a deficiency.

Aging and related health concerns: Several meta-analyses suggest that higher consumption or circulating levels of magnesium is associated with a lower risk of several age-related diseases.

Safety: Dietary magnesium is generally safe. Supplemental magnesium within recommended daily allowance is usually well tolerated in healthy adults. Diarrhea is the most common side effect. Those with renal impairment are at higher risk of adverse events.

Availability: Through diet, as a supplement, and as a prescription	**Dose**: The recommended daily dietary allowance for adults over 30 is 320 mg (women) and 420 mg (men), but there is thought to be little risk in excess dietary intake. The tolerable upper limit of supplemental magnesium for adults is 350 mg. Supplemental magnesium is typically taken orally, as a pill or as a liquid.	**Chemical formula:** Mg **MW:** 24 Daltons
Half-life: 42 days	**BBB**: Penetrant	
Clinical trials: The largest identified meta-analysis of RCTs included 2,709 participants	**Observational studies**: The largest identified meta-analysis included over 1.1 million participants	

What is it?

Magnesium (Mg) is a mineral that is required by all known living organisms. Magnesium is necessary for biological processes ranging from DNA synthesis to ion transport to generation of energy. In humans, magnesium has drawn particular attention for its role in brain, heart, and bone health, as well as its role in glucose metabolism. Magnesium can be found in many food items. Some rich sources of magnesium include pumpkin and chia seeds, almonds, cashews, spinach, black beans, edamame, and some breakfast cereals and other fortified foods (NIH Office of Dietary Supplements). Beyond its potential use in promoting cardiovascular health, improving glucose metabolism, and supporting cognitive function, magnesium can also have benefits for gut health by alleviating constipation and indigestion, for migraine headaches, and for other health conditions such as eclampsia in pregnancy (MSKCC; Fatima et al., 2024).

It is estimated that approximately 50 to 60% of Americans do not consume enough magnesium in their diet (Schwalfenberg & Genuis, 2017). Supplements containing magnesium are readily available. There are a variety of formulations of magnesium supplements, including magnesium hydroxide, magnesium sulfate, magnesium citrate, magnesium glycinate, and magnesium-L-threonate. These formulations have

different chemical properties, and different forms may be best suited for particular health conditions and/or individuals (Examine.com).

Chronic magnesium deficiency is associated with an increased risk of health conditions such as cardiovascular disease, type 2 diabetes, and osteoporosis (Fatima et al., 2024). However, assessing levels of magnesium in the body can be challenging. Approximately 50 to 60% of magnesium in the body is in bone. Less than 1% is found in blood serum, where it is held in a homeostatic range of approximately 0.75 to 0.95 mmol/L (NIH Office of Dietary Supplements; Schwalfenberg & Genuis, 2017). While testing blood levels of magnesium has clinical utility, serum levels may not correlate with total body magnesium or tissue-specific magnesium concentrations, particularly as the body can pull magnesium from organ systems in order to maintain homeostatic control; this leads to the possibility of subclinical magnesium deficiency (DiNicolantonio et al., 2018). Alternative testing approaches include assessments from different tissues including cerebral spinal fluid (CSF), hair, and urine; different forms of magnesium, such as ionized magnesium concentration in blood, serum, or plasma; or other approaches, such as the magnesium-loading test, also called a magnesium tolerance test. Assessment of magnesium status therefore may require both laboratory testing and clinical evaluation (NIH Office of Dietary Supplements).

Neuroprotective Benefit: Observational data suggests that having sufficient levels of circulating magnesium or higher intake of magnesium is associated with a lower incidence of dementia. It is not clear whether there is a benefit outside of treating a deficiency.

Types of evidence:

- 1 Cochrane systematic review and meta-analysis
- 2 meta-analyses or systematic reviews
- 4 randomized controlled clinical trials
- 19 observational studies
- 2 reviews
- Many laboratory studies

Human research to suggest prevention of dementia, prevention of decline, or improved cognitive function:

It is not known whether supplementation with magnesium improves cognitive function or prevents dementia.

A 2024 systematic review and meta-analysis by Chen et al., 2024 assessed the association between cognitive outcomes and magnesium intake, biomarkers, and supplementation in clinical trials and cohort studies. The authors included three double-blind RCTs in their review but reported that there was insufficient data to draw any conclusion. Two of the three studies were determined to be at high risk of bias; the one study that was rated a low risk of bias reported that participants who were over 65 and received magnesium glycinate for 12 weeks had a significant improvement in MoCA score over the course of the trial (9.1% improvement, p=0.03), while those in the placebo group had no significant change in this cognitive assessment. The researchers did not observe this improvement on cognitive assessments in participants under 65. It should be noted that this study specifically looked at individuals who consumed a diet with a high calcium:magnesium ratio, and the purpose of the study was to test whether reducing this ratio by increasing magnesium intake would be beneficial for this subgroup. (Zhu et al., 2020).

Two small studies were not included in the Chen et al., 2024 review. Liu et al., 2016 tested L-threonic acid magnesium salt (L-TAMS) in 44 patients with subjective memory complaints, anxiety, and sleep disorders. Participants received either L-TAMS (1.5 g or 2 g, depending on weight) or placebo for 12 weeks. The authors reported an improvement in overall cognitive ability in the treatment group compared to the placebo group. There were placebo effects on sleep and anxiety, and so the authors were unable to report on the potential effects of L-TAMS on these indices. Zhang et al., 2022 tested a similar compound called Magtein, which contains magnesium L-threonate along with phosphatidylserine and vitamins B_6, C, and D_3. This study enrolled 109 healthy adults aged 18 to 65 years who were randomized to receive either placebo or the magnesium-containing supplement. This study reported significant improvements in cognition in the treated group compared to placebo, particularly in older participants. However, it is not possible to determine which component(s) were responsible for the observed effect.

Many epidemiological studies have found associations between circulating magnesium and cognitive function or dementia diagnosis. The systematic review and meta-analysis by Chen and colleagues reported with moderate confidence that serum magnesium is associated with cognitive impairment and dementia. They found that there was a U-shape association. A serum magnesium concentration of 0.85 mmol/L was associated with the lowest incidence of dementia compared to magnesium levels less than

0.75 mmol/L (pooled HR=1.43; 95% CI 1.05 to 1.93) and also more than 0.95 mmol/L (pooled HR=1.30; 95% CI 1.03 to 1.64) (Chen et al., 2024). Other studies have also reported U-shaped associations between circulating magnesium levels and cognitive function such as Yang et al., 2023. Other studies have suggested that there is no benefit of increasing levels of magnesium past a certain concentration such as in Chen et al., 2021. It should be noted that other studies have reported a direct association between higher levels of serum magnesium and cognitive function like in Al-Ghazali et al., 2020.

The relationship between intake of magnesium and cognitive function has also been explored, but there is more inconsistency in these results. Chen et al., 2024 included five cohort studies that evaluated intake of dietary magnesium and incidence of all-cause dementia. All found at least some association between dietary magnesium intake and dementia incidence, but the exact relationships varied. In some studies, the highest level of magnesium intake was associated with lower incidence of dementia compared to the lowest intake of magnesium (Ozawa et al., 2012; Kimura et al., 2022). In other studies, a U-shaped association was reported such that the second highest quintile of magnesium intake was associated with a lower incidence of dementia compared to both the lowest and highest quintile (Lo et al., 2019; Takeuchi & Kawashima, 2023). In another study, higher dietary magnesium intake was associated with a higher incidence of dementia after statistical adjustment, but only in those with low calcium:magnesium intake ratios (Luo et al., 2022). Another cohort study reported that higher magnesium intake was associated with a lower incidence of mild cognitive impairment (Cherbuin et al., 2014).

Other studies not included in Chen et al., 2024 also reported associations between intake of magnesium and cognitive function and/or dementia diagnosis. Using data from the National Health and Nutrition Survey (NHANES) 2011 to 2014, researchers looked at the association between magnesium intake and cognitive impairment in older adults. With a sample size of 2,466 adults 60 years of age or older, the researchers found that higher intake of magnesium was associated with higher scores on cognitive testing compared to the lowest intake of magnesium, with reduced incidence of cognitive impairment at increasing intake levels of magnesium (Peeri et al., 2021).

Observational studies cannot establish causation. Dietary intake studies can have technical limitations, and in the case of magnesium, may not be able to account for sources of magnesium like drinking water (Chen et al., 2021). Another potential confounder for studies that look at circulating levels of magnesium is the exact testing method used for assessment of magnesium status. While too-low serum levels of magnesium certainly can signify a deficiency, a within-range serum level of magnesium does not

necessarily reflect an adequate level of magnesium at all tissues (NIH Office of Dietary Supplements). Different assessments may also lead to different conclusions when comparing groups. For instance, one research group looked at cognitive function and serum total magnesium and at serum ionized magnesium in adults over 65. When the authors compared those with cognitive impairment to those with no cognitive impairment, they found no significant differences in total magnesium levels. However, they did find that participants in the cognitively impaired group had significantly lower serum ionized magnesium levels than cognitively intact, age-matched controls (0.50 ± 0.01 mmol/L vs 0.53±0.01 mmol/L; $p<0.01$) (Barbagallo et al., 2011). The same group ran a similar study in patients with diabetes compared to healthy controls and also found more striking differences between the two groups when assessing serum ionized magnesium compared to total magnesium (Barbagallo et al., 2014). Whether serum ionized magnesium is the better biomarker is not yet clear; at this point, these data just reflect the potential confounders in observational studies that look only at serum magnesium levels.

Human research to suggest benefits to patients with dementia:

It is not known whether increasing magnesium can benefit patients with dementia. One small open-label study treated 15 patients with mild to moderate AD with L-threonic acid magnesium salt and reported a significant increase in MMSE treatment after 8 weeks, but the lack of placebo group and open-label design preclude drawing any conclusions about potential efficacy (Wroolie et al., 2017).

Epidemiological evidence suggests that there may be a decrease in circulating magnesium levels in patients with AD. A systematic review and meta-analysis of 21 studies assessed whether there were differences in levels of magnesium in blood and CSF in patients with AD compared to healthy controls. In a sample of 828 patients with AD compared to 884 controls, AD patients had less circulating magnesium in both serum (SMD= -0.54; 95% CI -1.07 to -0.01; p=0.045) and plasma (SMD=-1.88; 95% CI -2.97 to -0.79; p=0.001). There was a trend towards lower CSF magnesium levels in AD patients compared to healthy controls, but this difference was not significant (Du et al., 2022). The authors cautioned that the high degree of heterogeneity may affect their results. Two studies included in Du et al., 2022 reported direct correlations between levels of circulating magnesium and cognitive function and disease severity (Cilliler et al., 2007; Barbagallo et al., 2011).

An earlier, smaller systematic review found no differences in serum magnesium levels between AD patients and controls, but did find significantly lower levels of magnesium in hair and CSF in AD cases compared to controls (Veronese et al., 2016). Studies have also looked at other tissues samples; for

instance, one study reported that brain levels of magnesium were lower in brain tissue from patients with AD compared to control brain tissue (Andrasi et al., 2005).

More research is needed to determine whether magnesium levels are lower in patients with dementia than unaffected controls, and if so, if increasing magnesium levels provides any benefit to patients.

Mechanisms of action for neuroprotection identified from laboratory and clinical research:

Magnesium is an essential nutrient for the human body, and maintaining sufficient levels is important for brain health as well as overall health. Magnesium deficiency is common in older adults due to decreased intake and absorption, as well as from interactions with medications (Barbagallo et al., 2021).

In the brain, magnesium plays a critical role in neuronal health and in function. Magnesium modulates N-methyl-D-aspartate (NMDA) glutamate receptors, which underpin synaptic plasticity and thus learning and memory (Varga et al., 2025). Magnesium is also involved in modulating calcium homeostasis, oxidative stress, and inflammation (Barbagallo et al., 2021), and through these molecular mechanisms may help maintain the blood-brain barrier, myelin sheaths, and mitigate neuroinflammation and excitotoxic damage, among other roles (Chen et al., 2024).

Preclinical studies have also suggested several roles for magnesium that may be specific to Alzheimer's disease. At least one study has reported improvements in short- and long-term memory performance in healthy and aged rats after treatment with magnesium (Slutsky et al., 2010). Magnesium is a critical co-factor in the degradation of hyperphosphorylated tau (Zhang et al., 2005) while it also may inhibit GSK-3β, one of the kinases that pathogenically phosphorylates tau (Gomez-Ramos et al., 2006; Xu et al., 2014). In cell culture, magnesium reduces APP processing into the pathogenic amyloid-β form (Yu et al., 2010). Several studies in rodent models of AD suggest that elevating magnesium levels, either by oral supplementation or direct brain injection, can prevent AD-related cognitive impairment and improve neuronal and synaptic health (Li et al., 2013; Xu et al., 2014). Additional preclinical studies suggest that treatment with magnesium may be able to suppress amyloid beta plaque formation, decrease levels of inflammation, and improve some measures of cognition in Alzheimer's disease mouse models (Yu et al., 2015; Wang et al., 2015). Other studies have reported that magnesium may increase the proliferation of new neurons in young mice, as well as in aged mice after 12 months of treatment (Jia et al., 2016). Some of these studies have used magnesium L-threonate, one of many possible formulations of magnesium. One preclinical study suggests that threonate itself may increase intracellular magnesium levels and

increase synaptic density (Sun et al., 2016). While preclinical work and some small human studies report that certain forms of magnesium such as magnesium L-threonate may have greater benefits for neurological health (Liu et al., 2016; Zhang et al., 2022; reviewed in Barbagallo et al., 2021), this has not been confirmed in larger human trials.

There is some preclinical evidence that magnesium supplementation before traumatic brain injury (TBI) in rats attenuates the cognitive effects of injury (Enomoto et al., 2005; Hoane et al., 2008; Uysal et al., 2013). Similarly, magnesium treatment of rats after TBI may improve recovery and lessen post-TBI psychological dysfunction (Fromm et al., 2004; Turner et al, 2004). However, a Cochrane meta-analysis of clinical trials of magnesium supplementation in acute TBI reported finding no benefit for patients (Arango & Bainbridge, 2008).

APOE4 interactions:

It is not known whether magnesium status interacts with APOE genotype.

A study by Zhu et al., 2020 suggests a theoretical possibility of magnesium supplementation differentially affecting older individuals based on specific dietary patterns and APOE status. The researchers tested the effects of magnesium supplementation in adults who had a high intake ratio of calcium:magnesium. The researchers assigned participants to receive either magnesium glycinate or placebo for 12 weeks and tested cognitive function via the Montreal Cognitive Assessment (MoCA). The dose of magnesium was personalized to bring the participants to a target intake ratio of calcium:magnesium to 2.3. Cognitive function improved by 9.1% (p=0.03) in participants who were more than 65 years old and received magnesium supplementation, whereas there was no significant improvement in those who received placebo treatment. Interestingly, they found that 65+ year olds who received magnesium supplements had significant reductions in methylation modifications at two sites in the *APOE* gene. Previous studies have found that APOE4 carriers have the most methylation sites of any *APOE* allele (Ma et al., 2015) and at least one study has reported that increased methylation of *APOE* in blood DNA is inversely associated with cognitive function in some populations (Liu et al., 2018). More work is required to elucidate whether methylation modifications contribute to the differential impacts of the *APOE* alleles, and whether magnesium supplementation does indeed affect these modifications in a clinically meaningful way.

Aging and related health concerns: Several meta-analyses suggest that increased consumption or circulating levels of magnesium is associated with a decreased risk of several age-related diseases.

Types of evidence:

- 1 umbrella review of systematic reviews and meta-analyses
- 15 meta-analyses or systematic reviews
- 3 randomized clinical trials
- 9 observational studies
- 2 practice guidelines
- 4 reviews

Magnesium is an essential vitamin for the human body. Having sufficient levels of magnesium is critical to carrying out biological functions that are important at every life stage. However, many older adults are deficient in magnesium. The causes of this deficiency range from decreased intake of magnesium-rich foods, impaired absorption of magnesium, and experiencing health conditions and/or using medications like that affect magnesium levels. Circulating levels of magnesium may affect risk for age-related diseases such as cardiovascular disease, type 2 diabetes, and osteoporosis. Studies have also found that compared to higher circulating magnesium levels, lower magnesium levels are associated with inflammatory markers, oxidative stress, and systemic inflammation, even outside of any specific diagnosis (Barbagallo et al., 2021). Intake of magnesium has also been associated with lower incidence of conditions like frailty in men and women (Souza et al., 2023). One systematic review and meta-analysis found that dietary magnesium intake was associated with lower incidence of all-cause mortality (pooled effect size=0.87; 95% CI 0.79 to 0.97; p=0.009), though with significant heterogeneity (Bagheri et al., 2021), and with all the caveats necessary for an observational study of dietary intake of a mineral.

Migraines: PROBABLE BENEFIT

According to the American Headache Society and American Academy of Neurology, magnesium supplements are "probably effective and should be considered" for reducing the frequency or severity of migraines (Holland et al., 2012); the Canadian Headache Society similarly has a "strong recommendation" for magnesium supplements (Pringsheim et al., 2012). The American Headache Society recommends a dose of 400 to 500 milligrams of magnesium oxide a day for migraine prevention (American Headache Society).

Cardiovascular Health: POTENTIAL BENEFIT

Magnesium intake and/or supplementation has been suggested to improve cardiovascular health as measured by a variety of indices.

Multiple systematic reviews and meta-analyses have reported that levels of circulating magnesium are associated with incidence of cardiovascular disease or indices of heart health. A 2019 dose-response meta-analysis looked at the interaction between serum and dietary levels of magnesium and incidence of cardiovascular cases. The study comprised 544,581 participants across 18 prospective cohort studies. The researchers compared median serum magnesium or magnesium intake to the lowest serum level or intake and found that compared to low serum levels or intake, that there was a lower incidence of cardiovascular disease in those with relatively normal serum (RR=0.64; 95% CI 0.51 to 0.80) and dietary intake (RR=0.90; 95% CI 0.84 to 0.96). They found similar results for coronary heart disease (Zhao et al., 2019). Four other systematic reviews and meta-analyses have reported that low serum magnesium is associated with a higher incidence of cardiovascular disease (Del Gobbo et al., 2013; Fang et al, 2016; Wu et al., 2017; Rooney et al., 2020). Del Gobbo et al., 2013 also reported that circulating magnesium was associated with a trend toward a lower incidence of ischemic heart disease. A Mendelian randomization study looked at the association between cardiovascular disease and single nucleotide polymorphisms (SNPs) associated with magnesium. They found that genetic variations associated with higher magnesium levels were inversely associated with cardiovascular disease (Larsson et al., 2018). Circulating levels of magnesium have also been associated with blood pressure. One systematic review and meta-analysis found that higher circulating levels of magnesium were associated with lower incidence of hypertension (Tirani et al., 2015).

Studies have also shown positive associations between intake of dietary and/or supplemental magnesium and cardiovascular health. A systematic review and meta-analysis of RCTs of micronutrient supplementation reported that compared to control treatment, magnesium supplementation was associated with decreased systolic and diastolic blood pressure, increased levels of HDL cholesterol, and decreased levels of triglycerides (An et al., 2022). A retrospective cohort study of 94,239 veterans with diabetes found that patients who self-reported use of magnesium supplements had a lower incidence of heart failure (HR=0.94; 95% CI, 0.89 to 0.99) and major adverse cardiac events (HR=0.94; 95% CI, 0.90 to 0.97) compared to patients who did not report using magnesium supplements (Cheng et al., 2025). Other systematic reviews and meta-analyses of RCTs looking at the effects of magnesium supplementation on blood pressure also reported that those treated with magnesium had lower systolic (-2.81 mm Hg; 95% CI -4.32 to -1.29) and diastolic blood pressure (-2.05 mm Hg; 95% CI, -3.23 to -0.88)

compared to placebo, with greater effects seen in hypertensive participants and no significant change seen in normotensive participants (Argeros et al., 2025).

Magnesium may be involved in other aspects of cardiovascular or cerebrovascular health. One meta-analysis has reported that magnesium intake is inversely associated with incidence of stroke (Zhao et al., 2020), and observational studies have found that dietary magnesium intake is associated with lower incidence of heart failure (Taveira et al., 2016; Wu et al., 2020).

However, there is heterogeneity in many of these systematic reviews and meta-analyses, and the field lacks full consensus. For instance, a systematic review and meta-analysis of clinical trials by Amer et al., 2025 reported that magnesium supplementation significantly reduced diastolic but not systolic blood pressure. Behers et al., 2024 performed a systematic review and meta-analysis of placebo-controlled magnesium supplement studies and found a significant decrease in systolic blood pressure in normotensive patients at doses of more than 360 mg per day and durations greater than 3 months, in contradiction to Argeros et al., 2025. Other observational studies find no association between intake and coronary heart disease or mortality due to cardiovascular disease when they compare the group with the highest intake of magnesium compared to the lowest (Song et al., 2005; Deng et al., 2013). The discrepancy between the results of studies could be due to several technical factors, such as challenges of self-reported dietary intake data or differences in doses, durations, formulations, and study population characteristics. The differences in studies could also be due in part to biological factors such as vitamin D status, as Deng et al., 2013 found a significant interaction between vitamin D levels and magnesium in relation to mortality from cardiovascular disease. More work is needed to confirm the potential effects of magnesium on heart health.

Type 2 Diabetes: POTENTIAL BENEFIT

Magnesium is thought to influence blood sugar levels, and body levels of magnesium may be associated with type 2 diabetes. An umbrella review of systematic reviews and meta-analyses of both observational and interventional studies reported that there was "highly suggestive" evidence that higher intake of magnesium was associated with decreased incidence of type 2 diabetes (Veronese et al., 2020). For instance, one study included in the umbrella review meta-analyzed RCTs that tested magnesium supplementation compared to placebo in patients at risk for or with diabetes. The researchers found that compared to placebo, magnesium supplementation reduced fasting glucose in patients with diabetes as well as improved markers of insulin sensitivity in patients at risk for diabetes (Veronese et al., 2016).

Other meta-analyses published after Veronese et al., 2020 also report a lower incidence of type 2 diabetes diagnosis in prospective cohort studies in participants with the highest magnesium intake compared to the lowest (Zhao et al., 2020). A pooled analysis of 24 RCTs of patients with diabetes found that compared to those who received control treatment, patients who received magnesium supplements had improvements in fasting blood glucose, $HbA1_c$, and systolic and diastolic blood pressure (Xu et al., 2023).

Not all systematic reviews and meta-analyses find benefit of magnesium for blood glucose handling (An et al., 2022); more work will be needed to identify whether increasing magnesium intake does prevent and/or treat diabetes.

Osteoporosis: POTENTIAL FOR BENEFIT

Magnesium is a major component of bone and is essential for bone health. A systematic review and meta-analysis reported that higher intake of magnesium was significantly associated with increased bone mineral density in the hip, though they cautioned that more studies were needed to thoroughly explore the effects of intake of magnesium and bone health (Groenendijk et al., 2022). Another systematic review and meta-analysis examined the association between serum magnesium levels and incidence of fractures. They reported that lower serum magnesium was associated with higher incidence of fracture (RR=1.579; 95% CI 1.216 to 2.051; p=0.001) (Dominguez et al., 2023).

Cancer: POTENTIAL FOR BENEFIT

Some studies have found a lower incidence of certain kinds of cancer (Ko et al., 2014; Shah et al., 2020) or lower cancer mortality (Bagheri et al., 2021) in those with higher magnesium intake compared to lower intake. However, it is difficult to separate out the effects of magnesium from the dietary fiber that is also found in many magnesium rich foods and can also influence health outcomes like cancer and other age-related diseases.

Safety: Dietary magnesium is generally safe. Supplemental magnesium within recommended daily allowance is usually well tolerated in healthy adults. Diarrhea is the most common side effect. Those with renal impairment are at higher risk of adverse events.

Types of evidence:

- 1 systematic review of clinical trials
- 1 observational study

- 2 professional guidelines
- 3 reviews

According to the NIH Office of Dietary Supplements, dietary magnesium generally does not pose a health risk to healthy individuals, as excess magnesium is excreted by the kidneys (NIH Office of Dietary Supplements).

Magnesium from supplements or medications can lead to side effects. The most common side effects of magnesium supplementation are digestive complaints such as diarrhea, nausea, and abdominal cramping; these are more common at higher doses (MSKCC). Diarrhea is more commonly reported with particular forms of magnesium, including magnesium carbonate, magnesium chloride, magnesium gluconate, and magnesium oxide (NIH Office of Dietary Supplements).

Overdoses or magnesium toxicity have been reported with doses several magnitudes higher than the recommended daily doses and/or in people with underlying health issues, such as renal impairment or in young children or older adults (NIH Office of Dietary Supplements; MSKCC; Souza et al., 2023). Symptoms of magnesium toxicity can include hypotension, nausea, vomiting, flushing, lethargy, irregular heartbeat, and muscle weakness (NIH Office of Dietary Supplements; Hicks & Tyagi, 2023).

Individuals with renal impairment or bowel disorders such as bowel obstruction should speak with their medical provider before starting a magnesium supplement (MSKCC; NIH Office of Dietary Supplements).

A systematic review examined 49 clinical trials of magnesium supplementation as a treatment for hypertension. Of these trials, no serious adverse reaction was reported. The maximum reported dose with 972 mg per day. The adverse events reported were minor, transient, and often reported in both treatment and control groups (Rosanoff et al., 2021).

Drug interactions:

Magnesium supplements can interact with a variety of medications. Laxatives can negatively affect absorption of other medications. Therefore, if a magnesium supplement is being used as laxative, or at doses that can or are leading to laxative effects, then the magnesium supplement should be taken at least two hours before or after other medications (Drugs.com).

Bisphosphonates, commonly used to treat osteoporosis, are absorbed less well in the presence of magnesium; thus, magnesium-rich supplements or medications should be taken at least two hours apart from bisphosphonate medication. Tetracyclines and quinolones antibiotics can form insoluble complexes with magnesium; these antibiotics should be taken at least 2 hours before or 4 to 6 hours after taking a magnesium-containing or coated supplement (NIH Office of Dietary Supplements). Magnesium can have an additive effect for certain blood pressure medications like calcium channel blockers, and also for some types of antidiabetic medications like sulphonylurea medications by potentially lowering blood sugar levels (MSKCC).

Other medication types can affect levels of magnesium in the body and thus may factor into the decision of whether to take a supplement containing magnesium. Proton pump inhibitors (PPI) can cause hypomagnesemia, and the FDA has recommended that healthcare professionals consider assessing baseline serum magnesium and then monitoring this level for long-term PPI treatment (NIH Office of Dietary Supplements; FDA). Different diuretics, including loop diuretics and potassium-sparing diuretics, can also affect magnesium levels in the body (NIH Office of Dietary Supplements).

Each form of magnesium may have interactions with different medications; it is important to speak to your medical professional and pharmacist before adding new medications or supplements.

Magnesium can also interact with other vitamins in complex ways. Magnesium is required for conversion of vitamin D into its active form, and vitamin D also can stimulate the absorption of magnesium in the digestive system; treating a deficiency of either vitamin may require increasing intake of both (Uwitonze & Razzaque, 2018).

Research underway:

There are currently two ongoing trials registered on clinicaltrials.gov that are assessing the effects of magnesium on some aspect of cognition. No study is investigating whether magnesium supplementation or magnesium levels have any impact on dementia diagnosis, prognosis, or other related question.

NCT05132517 is an ongoing observational study that aims to enroll 80 participants who have experienced a stroke. This study will assess the relationship between serum magnesium level and the cognitive function of these patients.

NCT06702488 is assessing the effects of intraoperative magnesium sulfate compared to intraoperative dexmedetomidine on incidence of post operative cognitive dysfunction and serum levels of CRP in adults who are 60 to 80 years old.

Search terms:

Pubmed, Google: magesium

- Cognitive function, dementia, Alzheimer's, type 2 diabetes, blood glucose, cardiovascular disease, lipid profile, blood pressure, migraines, osteoporosis

Websites visited for magesium:

- Clinicaltrials.gov
- Examine.com
- Drugs.com
- WebMD.com
- PubChem
- DrugBank.ca
- Labdoor.com
- ConsumerLab.com