Magnesium

RDA. 51+ years male420 mg. Female 320 mg
Pumpkin seeds (hulled, roasted): 1 oz = 150 mg of magnesium
Peanuts (dry roasted): 1 oz = 49 mg of magnesium.
Shredded wheat (plain, unfrosted): 1 cup = 56 mg of magnesium.
Milk (nonfat): 1 cup = 24 to 27 mg of magnesium
Yogurt (plain, low fat): 8 oz = 42 mg of magnesium.
Dark chocolate (70%-85% cocoa): 1 oz = 64 milligrams of magnesium.
Water saskatoon 19mg/L

https://www.ncbi.nlm.nih.gov/books/NBK507261/
Magnesium and cancer: more questions than answers
The relationship between Mg and cancer is still a puzzle to disentangle. The knowledge derived from preclinical studies reveals a complex scenario in which low magnesium has both anti- and pro-tumour effects, such as inhibition of tumour growth at its primary site and facilitation of tumour implantation at its metastatic sites. In different cell types, neoplastic transformation dramatically disrupts the controlled and coordinated fluctuations of intracellular magnesium, an event that offers selective advantages to the cells. It is difficult to translate the lesson learnt from experimental models to humans. Based on epidemiological studies, Mg deficiency seems to be linked to increased risk of some types of cancers. The demonstration of an impairment of magnesium homeostasis in oncologic patients further complicates the field. We need more translational and clinical data to draw firm conclusions about the contribution of magnesium to tumours.

https://pubmed.ncbi.nlm.nih.gov/21933757/
Magnesium and cancer: a dangerous liason. 2011
In magnesium-deficient mice, low magnesium both limits and fosters tumorigenesis, since inhibition of tumor growth at its primary site is observed in the face of increased metastatic colonization. Epidemiological studies identify magnesium deficiency as a risk factor for some types of human cancers. In addition, impaired magnesium homeostasis is reported in cancer patients, and frequently complicates therapy with some anti-cancer drugs.

https://pubmed.ncbi.nlm.nih.gov/39200180/
Magnesium Ion: A New Switch in Tumor Treatment. 2024
The magnesium ion is an essential cation in the human body and participates in numerous physiological activities. A deficiency in magnesium ions is closely associated with tumor development, and supplementation with magnesium ions has been shown to partially inhibit tumor growth. However, the specific mechanisms by which magnesium ions suppress tumor proliferation remain unclear. Currently, studies have revealed that mitochondria may serve as a crucial intermediate link in the regulation of tumors by magnesium ions. Mitochondria might intervene in the proliferation and invasion of tumor cells by modulating energy metabolism and oxidative stress levels. Regrettably, there has been no comprehensive review of the role of magnesium in cancer therapy to date. Therefore, this article provides a comprehensive scrutiny of the relationship between magnesium ions and tumors, aiming to offer insights for clinical tumor treatment strategies involving magnesium ion intervention.

https://pubmed.ncbi.nlm.nih.gov/38638143/
Mg alloys with antitumor and anticorrosion properties for orthopedic oncology: A review from mechanisms to application strategies. 2024
As a primary malignant bone cancer, osteosarcoma (OS) poses a great threat to human health and is still a huge challenge for clinicians. At present, surgical resection is the main treatment strategy for OS. However, surgical intervention will result in a large bone defect, and some tumor cells remaining around the excised bone tissue often lead to the recurrence and metastasis of OS. Biomedical Mg-based materials have been widely employed as orthopedic implants in bone defect reconstruction, and, especially, they can eradicate the residual OS cells due to the antitumor activities of their degradation products. Nevertheless, the fast corrosion rate of Mg alloys has greatly limited their application scope in the biomedical field, and the improvement of the corrosion resistance will impair the antitumor effects, which mainly arise from their rapid corrosion. Hence, it is vital to balance the corrosion resistance and the antitumor activities of Mg alloys. The presented review systematically discussed the potential antitumor mechanisms of three corrosion products of Mg alloys. Moreover, several strategies to simultaneously enhance the anticorrosion properties and antitumor effects of Mg alloys were also proposed

https://pubmed.ncbi.nlm.nih.gov/38630209/
Comparison of trace elements in peripheral blood and bone marrow of newly diagnosed multiple myeloma patients. 2024
Trace elements are essential micronutrients for the human body. Their roles are indispensable, as they are involved in a wide range of vital biological processes. In this study, we aimed to evaluate alterations in trace elements in the blood and bone marrow serum of patients with newly diagnosed multiple myeloma (NMM). The levels of zinc (Zn), copper (Cu), iron (Fe), manganese (Mn), magnesium (Mg), selenium (Se), arsenic (As), boron (B), nickel (Ni), silicon (Si) and chromium (Cr) were analyzed in the venous blood samples of the patient group comprising 70 patients with NMM (41 males and 29 females) and compared to those in the control group comprising 30 individuals (18 males and 12 females). In addition, trace element levels were analyzed in bone marrow samples from the patient group. Blood and bone marrow serum levels were quantified using inductively coupled plasma optical emission spectrometry. When the blood samples of the patient and control groups were compared: Zn ($p = 0.011$), Fe ($p = 0.008$), Mn ($p = 0.046$), Se ($p < 0.001$), As ($p < 0.001$), Ni ($p < 0.001$) and Cr ($p < 0.001$) levels were significantly higher in the patient group than in the control group. Higher Zn, Fe, Mn, Se, As, Ni and Cr levels in the NMM patients suggest that alterations of trace elements could be predisposing factor that initiates the malignant process. The relationship between malignancies and trace elements is crucial for the development of adjuvant therapy strategies and preventive medicine and as biomarkers for cancer diagnosis. Therefore, there is a need for studies examining the relationship between hematological malignancies and trace elements.

https://pubmed.ncbi.nlm.nih.gov/35368816/
Hypomagnesemia in the Cancer Patient. 2020
Hypomagnesemia is a common medical problem that contributes to the morbidity and mortality of patients with cancer.
Patients with cancer are at risk for opportunistic infections, frequently experience cardiovascular complications, and often receive classes of medications that cause or exacerbate hypomagnesemia. Also, cancer-specific therapies are responsible for hypomagnesemia, including platinum-based chemotherapy, anti-EGF receptor mAbs, human EGF receptor-2 target inhibitors (HER2), and calcineurin inhibitors.
We recommended checking serum magnesium at the beginning of treatment and as part of routine monitoring throughout cancer treatment.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8669698/
Oral magnesium supplements for cancer treatment-induced hypomagnesemia: Results from a pilot randomized trial. 2021
Optimal management of cancer treatment-induced hypomagnesemia (hMg) is not known. We assessed the feasibility of using a novel pragmatic clinical trials model to compare two commonly used oral Mg replacement strategies.
Patients with grade 1 to 3 hMg while receiving either platinum-based chemotherapy or epidermal growth factor receptor inhibitors (EGFRI) were randomized to oral magnesium oxide (MgOx) or oral magnesium citrate (MgCit).
Hypomagnesemia (hMg) is a common side effect of both platinum-containing chemotherapy and epidermal growth factor receptor inhibitors (EGFRIs). The reported incidence is approximately 90% in patients receiving cisplatin, 27% with panitumumab (pmab), and 18% with cetuximab (cmab). 1 , 2 The consequences of hMg include fatigue, nausea and vomiting, neuromuscular changes, mental status changes and cardiac arrhythmias, potentially resulting in treatment delays, and compromised treatment efficacy. 3
Despite the high incidence of hMg, little is known regarding effective management. 4 , 5 , 6 In most patients with severe (grade 3/4) hMg, high-dose intravenous (IV) magnesium replacement is commonly used, however, this does not achieve sustainable magnesium repletion beyond 72 hours, suggesting that such a strategy is both suboptimal and inconvenient for patients. 7
. A recent review of magnesium supplements has suggested that magnesium citrate (MgCit) may have the best bioavailability. 10 Given this uncertainty, it is not surprising that a survey of oncologists showed that a variety of replacement strategies are used in practice. The majority of respondents used a combination of oral and IV supplements depending on the grade of hMg, with magnesium oxide (MgOx), magnesium rougier, and MgCit being the most commonly used oral agents. 11

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4705892/
Magnesium intake and incidence of pancreatic cancer: the VITamins and Lifestyle study
Every 100 mg per day decrement in magnesium intake was associated with a 24% increase in the incidence of pancreatic cancer (HR: 1.24; 95% CI: 1.02, 1.50; Ptrend=0.03). The observed inverse associations appeared not to be appreciably modified by age, gender, body mass index, and non-steroidal anti-inflammatory drug use but appeared to be limited to those taking magnesium supplementation (from multivitamins or individual supplement).

https://www.nature.com/articles/s41598-019-42282-y
Direct and indirect associations between dietary magnesium intake and breast cancer risk. 2019
A higher magnesium intake was associated with a lower breast cancer risk (adjusted OR = 0.80, 95% CI = 0.65, 0.99). A positive association was found between the CRP level and breast
cancer risk (adjusted OR = 1.43, 95% CI = 1.02–2.01).

https://www.sciencedirect.com/science/article/abs/pii/S0268960X20300266
Magnesium: The overlooked electrolyte in blood cancers? 2020
Magnesium is an important element that has essential roles in the regulation of cell growth, division, and differentiation. Mounting evidence in the literature suggests an association between hypomagnesemia and all-cause mortality. In addition, epidemiologic studies have demonstrated that a diet poor in magnesium increases the risk of developing cancer, highlighting its importance in the field of hematology and oncology. In solid malignancies, hypomagnesemia at diagnosis portends a worse prognosis.

https://ajcn.nutrition.org/article/S0002-9165(23)02950-7/fulltext
Magnesium intake and colorectal tumor risk: a case-control study and meta-analysis1234
In the meta-analysis, every 100-mg/d increase in magnesium intake was associated with 13% lower risk of colorectal adenomas (OR: 0.87; 95% CI: 0.75, 1.00) and 12% lower risk of colorectal cancer (RR: 0.88; 95% CI: 0.81, 0.97).
Conclusions: Our findings support the hypothesis that higher intakes of dietary magnesium are associated with lower risk of colorectal tumors. The consumption of magnesium-rich foods may be a new avenue to explore further in the search for cancer-prevention strategies.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10375690/
A narrative review on the role of magnesium in immune regulation, inflammation, infectious diseases, and cancer. 2023
Magnesium (Mg) has gained much importance recently because of its unique range of biological functions. It is one of the most significant micronutrients in biological systems.
It additionally boasts a significant anti-cancer effect. Chronic Mg deficiency leads to enhanced baseline inflammation associated with oxidative stress, related to various age-associated morbidities.
The majority of Mg2+ in the human body, exceeding 99% of the total amount, is found within the intracellular compartment. Its primary storage site is the skeletal system/bones, accounting for approximately 50–65% of the total body Mg2+. In conjunction with calcium and phosphorus, Mg2+ contributes to the structural composition of the skeleton. Additionally, Mg2+ is distributed among muscle tissue, soft tissues, and organs, constituting approximately 34–39% of the total body Mg2+. Conversely, a small fraction of Mg2+, less than 1–2%, is present in the bloodstream and extracellular fluids [1].
Mg is also essential for the synthesis and distribution of vitamin D, which plays a crucial role in the immune response against viral pathogens [11].
Additionally, the presence of Mg2+ plays a crucial role in regulating the levels of "intracellular free Ca2+ and intracellular pH". These factors are significant determinants in various cellular processes such as "cell contraction, secretion, motility, and proliferation".
, sources of Mg that are regarded as beneficial include “seeds, legumes, nuts (such as almonds, cashews, Brazil nuts, and peanuts), whole grain bread and cereals (such as brown rice and millet), select fruits, and cocoa".
The current recommended daily allowance (RDA) for Mg in adults is 4.5 mg per Kg of body weight in a day, which represents a decrease from the previous recommendation range of 6–10 mg per kg of body weight per day. The daily nutritional needs are elevated during pregnancy, lactation, and in the aftermath of a debilitating illness. Recent dietary surveys indicate that the average dietary intake in numerous Western countries falls below the recommended daily allowance (RDA) [17].
The consumption of water can serve as a significant means of obtaining Mg, particularly in the case of “hard water” that may contain Mg levels of up to 30 mg/L. Moreover, the process of cooking, particularly the act of boiling foods that are rich in Mg, leads to a substantial reduction in Mg content.
Mg consumption in numerous populations could be elucidated [18].
Mg deficiency, which is common in old age, is strongly linked to inflammation through a variety of mechanisms [27].
Mg deficiency is associated with enhanced generation of free oxygen radicals in several tissues.
Mg deficiency in several experimental studies reported altered mitochondrial functions such as alteration of respiration, increased mitochondrial ROS generation, and blockade of antioxidant defense system (e.g., superoxide dismutase, vitamin E, catalase, glutathione) [45].

According to a study, Mg supplementation improves mitochondrial function through various mechanisms like mitochondrial ROS inhibition, modulation of permeability, and mitochondrial transition pore opening [49].
Various studies conducted in animal models have shown that Mg may have a protective effect against certain types of cancer in the early stages of chemical carcinogenesis [51,
One study found that Mg in the diet slowed tumor development in young male rats with Walker 256/M1 carcinosarcomas by inhibiting glutathione synthesis, which requires Mg as a cofactor [56]. Diet that includes Mg can inhibit the growth of certain types of cancer cells, including Lewis lung carcinoma, mammary adenocarcinoma, and colon cancer [57].
Mg deficiency can lead to the activation of TNF, as well as IL-1 and IL-6 [59], which can increase the potential for cancer cells to spread [60].
Research suggests that low levels of Mg can contribute to an increased risk of developing certain types of cancer, such as colorectal cancer, pancreatic cancer, and breast cancer.
Inflammation is a significant contributor to the development of cancer and can worsen cancer-related symptoms. Therefore, Mg deficiency can exacerbate inflammation, potentially leading to more severe cancer-related complications.
intake and reduced cancer mortality, with a 5% decrease in cancer mortality observed for every 100 mg/d increase in Mg intake [65]. In addition, some studies have found that Mg deficiency may be linked to an increased risk of colon cancer [66, 67], while others have observed a significant inverse association between dietary Mg and colon cancer in men, but not women [68]. Interestingly, lower dietary Mg intake may be associated with increased production of N-nitroso compounds, which are carcinogens, in colon cancer patients [69].
Mg intake was associated with poorer DNA repair capacity and an increased risk of developing lung cancer.
The findings suggest that having a diet rich in Mg may decrease the risk of lung cancer. However, when low-Mg intake and suboptimal dose–response relationship curve are present together, the odds ratio for lung cancer increases to 2.36, regardless of gender.
Magnesium interactions with anti-cancer agents
Ascorbic acid
L-ascorbic acid (AA), also termed vitamin C, is a polyunsaturated fatty acid with antioxidant and prooxidant properties. The impact of AA on cancer cells is based on the hormetic effect, characterized by low-dose stimulation and high-dose inhibition. In other words, AA is only effective against cancer cells in higher quantities because of its prooxidant properties. The cellular absorption of AA is determined by the sodium-dependent vitamin-C transporter family-2 (SVCT2). Low SVCT2 expression on tumor cells is tumoricidal at high doses of AA but has a proliferative effect at low doses of AA. In contrast, tumor cells with high SVCT2 expression exhibit anti-cancer outcomes even at low AA concentrations [74]. Cho et al. demonstrated that Mg ions can enhance the expression of SVCT 2, which increases its Vmax value. Molecular analysis data have confirmed the enhanced expression of cancer proliferation markers in the hormetic dose response [75]. **These findings addressed that Mg can enhance the anti-cancer effects of AA.**
This suggests that enhancing Mg intake could potentially serve as a cost-effective and economically viable strategy for immune regulation and preventing cancer.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5926493/
Magnesium and Human Health: Perspectives and Research Directions. 2018
Low magnesium intake is associated with an increased risk of stroke in several observational studies [163–165], which can be explained by the beneficial role of magnesium in endothelial function, platelet aggregation, blood pressure, and glycemic control as discussed in the previous section. Patients suffering acute ischemic stroke and admitted with low magnesium levels have an increased inpatient mortality risk [166] and increased intensity of neurological deficit [167]. This might be attributed to the cerebral vasoconstriction triggered by hypomagnesemia.

https://pubmed.ncbi.nlm.nih.gov/29679349/
Timeline (Bioavailability) of Magnesium Compounds in Hours: Which Magnesium Compound Works Best? 2019
The aim of this study is to investigate the bioavailability of five different magnesium compounds (magnesium sulfate, magnesium oxide, magnesium acetyl taurate, magnesium citrate, and magnesium
malate) in different tissues. Following a single dose 400 mg/70 kg magnesium administration to Sprague Dawley rats, bioavailability was evaluated by examining time-dependent absorption, tissue penetration, and the effects on the behavior of the animals. Pharmacokinetically, the area under the curve calculation is highest in the magnesium malate. The magnesium acetyl taurate was found to have the second highest area under the curve calculation. Magnesium acetyl taurate was rapidly absorbed, able to pass through to the brain easily, had the highest tissue concentration level in the brain, and was found to be associated with decreased anxiety indicators. Magnesium malate levels remained high for an extended period of time in the serum. The commonly prescribed dietary supplements magnesium oxide and magnesium citrate had the lowest bioavailability when compared to our control group. More research is needed to investigate the bioavailability of magnesium malate and acetyl taurate compounds and their effects in specific tissues and on behavior.