An update on vitamin and mineral supplementation: is it essential?

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Abstract

Multivitamin/mineral (MVM) supplements are among the most popular dietary supplements worldwide, often marketed as a simple solution to enhance overall health, fill nutritional gaps in the diet and prevent deficiencies. With a staggering variety of options available, one might wonder: Are MVMs really essential for everyone?

Keywords: multivitamin/mineral supplements (MVMs), dietary supplements, micronutrients, health benefits, chronic diseases, memory, cognitive health, vitamins and minerals

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Understanding MVM supplements

Multivitamin/minerals (MVMs) are dietary supplements that combine a variety of vitamins, minerals, and other nutritional components that are essential for various bodily functions. There is no standard definition or regulatory guideline that specifies which nutrients must be included in a MVM or in what quantities. Consequently, MVM formulations can vary significantly between different brands and products. Some MVMs also include additional ingredients such as fatty acids, amino acids, enzymes, probiotics, herbs, and botanical extracts.[1,2]

MVMs are popular due to their perceived safety at low doses, affordability, and convenience, allowing individuals to take a single supplement instead of multiple different pills.[3]

A study published in the American Journal of Clinical Nutrition found that MVM use could improve nutrient status in individuals[3] at risk of, or with confirmed deficiencies, such as those with poor diets, alcoholics, chronic conditions or malabsorption disorders, a history of bariatric surgery and vegans.[1]

Why are vitamins and minerals important?

Vitamins and minerals are essential micronutrients required for numerous critical functions in the body. They play key roles in various enzyme systems, tissue maintenance, bone and teeth formation, and overall health. Additionally, they are crucial for energy production, immune function, and cellular repair. Since our bodies cannot synthesise these essential nutrients, they must be obtained through our diets.[3,4]

The power of a varied diet

A varied and balanced diet rich in nutrient-dense foods—such as fruits, vegetables, whole grains, and dairy products—typically provides the necessary amounts of vitamins and minerals. However, not everyone meets their nutritional needs through diet alone. Several factors, including food choices and availability, socioeconomic status, and lifestyle habits, often prevent people from achieving an optimal diet, leading to nutritional gaps.[1,3] In such cases, MVM supplements may become a means to meet adequate intake requirements.[3]

The limitations of existing research

Observational studies: a double-edged sword

Most studies examining the potential benefits of MVMs in enhancing health and preventing disease are observational. These studies typically compare individuals who choose to take MVM supplements with those who do not. A significant limitation of this approach is that people who use dietary supplements often have healthier diets and lifestyles overall. This makes it challenging to attribute health benefits directly to supplement use, separate from the benefits of healthy behaviours.[3]

Furthermore, MVM users tend to have higher micronutrient intakes from their diet alone compared to non-users. Ironically, those at the highest risk of nutritional inadequacy—such as pregnant and breastfeeding individuals, adult women, people of low socioeconomic status, and individuals who are underweight or overweight—are the least likely to take MVMs.[3]

Randomised controlled trials (RCTs): the gold standard

Randomised controlled trials (RCTs), where participants are randomly assigned to take either a dietary supplement or a placebo, are more reliable than observational studies for determining whether MVMs might affect disease risk. However, only a few RCTs have been conducted due to the lengthy duration required to demonstrate significant effects on disease risk, beyond merely identifying intermediate biomarkers.[3]

Even among the RCTs that have been conducted, results are mixed. Some have suggested potential health benefits from MVM use, while others have found no such benefits. Notably, no two RCTs have used MVMs with the same combinations and amounts of nutrients, further complicating the interpretation of results.[3]

MVMs and disease prevention: what does the evidence say?

Can MVMs prevent chronic diseases?

The role of MVMs in preventing chronic diseases such as cardiovascular disease (CVD) and cancer is debated. Large-scale studies have produced mixed results regarding their effectiveness. For instance, the Women's Health Initiative and Physicians' Health Study II (PHS II) found no strong evidence that MVMs reduce the risk of major chronic diseases in the general population.[1,5]

Cardiovascular disease (CVD)

A meta-analysis of 16 prospective cohort studies and two RCTs, involving over two million participants, found no significant association between MVM use and improved cardiovascular outcomes, such as reduced mortality from CVD or stroke.[3]

The PHS II conducted between 1997 and 2011 with over 14 000 male physicians aged 50 and older, found that daily MVM (specifically Centrum Silver) use did not significantly reduce the risk of major cardiovascular events.[6]

The COcoa Supplement and Multivitamin Outcomes Study (COSMOS), which involved over 21 000 older adults across the United States, found that neither cocoa extract supplementation nor MVM (specifically Centrum Silver) use significantly lowered the incidence of major cardiovascular events. Although cocoa flavanols might offer cardiovascular benefits, these were not consistent across all participants.[7]

The United States Preventive Services Task Force (USPSTF) concluded that beta-carotene supplementation likely causes more harm than good for CVD prevention, and vitamin E supplementation offers no net benefit. The task force found insufficient evidence to determine whether MVMs or other nutrients provide any net benefit or harm in CVD prevention.[8]

Cancer

The PHS II study did suggest a modest reduction in cancer risk among participants taking daily MVMs, with an 8% reduction in total cancer incidence. However, this was not substantial enough to recommend MVM use solely for cancer prevention.[6]

The COSMOS study found that daily MVM use did not significantly reduce overall cancer risk, though there was a slight trend toward reduced cancer risk in those with a history of cancer. The evidence was not strong enough to make general recommendations for MVM use for cancer prevention.[7]

The USPSTF similarly found insufficient evidence to determine whether MVM supplements provide any net benefit or harm in cancer prevention. Beta-carotene supplementation is likely harmful, and vitamin E supplementation does not provide a net benefit. Evidence is also insufficient to evaluate the benefits and harms of other nutrients for cancer prevention.[8]

Cognitive health

MVMs are critical for brain function and may impact cognitive processes through their role in energy metabolism, DNA synthesis, oxygen transport, and neuronal function.[3] Evidence suggests MVMs might support cognitive health, particularly in older adults. A study in *JAMA Neurology* found that long-term MVM use was associated with a slower rate of cognitive decline, though further research is needed.[3]

The PHS II study found no significant difference in cognitive decline or dementia risk between those taking daily MVMs and those on a placebo.[6]

The COSMOS-Mind study, published in *Alzheimer's & Dementia*, investigated the effects of MVM supplementation on cognitive function in older adults. It suggested that MVMs might enhance cognitive function by reducing oxidative stress, addressing micronutrient deficiencies, or improving vascular health. While MVMs did not significantly reduce mild cognitive impairment (MCI), they showed a modest improvement in global cognitive function, particularly in individuals with CVD. In the COSMOS-Clinic sub-cohort, MVM supplementation showed a statistically significant effect on episodic memory compared to placebo.[9]

A meta-analysis of over 5 000 participants from three COSMOS cognitive sub-studies demonstrated clear benefits of MVMs on global cognition and episodic memory. Daily MVM use over two to three years may reduce cognitive ageing by approximately two years compared to placebo.

The safety of continuous MVM use

Safety and risks

For most people, the continuous use of MVMs is generally considered safe when taken at recommended doses. However, excessive intake of certain vitamins and minerals can lead to adverse effects. High doses of fat-soluble vitamins (A, D, E, and K), for example, can accumulate in the body and potentially cause toxicity.[10]

A review in *Nutrients* highlights the importance of adhering to recommended daily allowances and avoiding excessive supplementation to prevent potential adverse effects. For individuals who take multiple supplements or consume fortified foods and beverages, there is a risk of exceeding the upper limit for certain nutrients, which could increase the possibility of adverse effects.[3]

Specific risks for certain populations

Smokers and, potentially, former smokers should avoid MVM products that provide large amounts of beta-carotene or vitamin A. Studies have linked these nutrients to an increased risk of lung cancer in smokers. For instance, a RCT involving male Finnish smokers found that those who took supplemental beta-carotene had a higher incidence of lung cancer compared to those who took a placebo or vitamin E.[3]

Additionally, taking excess vitamin A during pregnancy can increase the risk of birth defects. Thus, the recommended upper limit for vitamin A during pregnancy is 2 800 mcg/day for adolescents and 3 000 mcg/day for women.[3]

MVMs that provide nutrients in recommended amounts typically do not interact with medications. However, there is a notable exception. Individuals taking blood thinners, such as warfarin, should consult their healthcare providers before using any MVMs or dietary supplements containing vitamin K. Vitamin K plays a role in blood clotting and can reduce the effectiveness of warfarin and similar medications.

The bottom line: are MVMs necessary?

Continuous MVM supplementation may not be necessary for everyone, especially those who maintain a balanced and varied diet. However, for individuals with specific nutritional needs, restricted diets, or certain health conditions, MVMs can be a useful tool to fill gaps in nutrient intake. It is crucial to base supplementation on individual health needs.[5]

MVMs should not be viewed as a catch-all solution for achieving optimal health. Evidence regarding their health benefits for the general population remains inconsistent, and in some cases, they may even cause harm. If you have a specific nutrient deficiency, targeted supplementation with that nutrient is often more effective than taking a MVM.[3]

Unanswered questions

Despite the potential benefits, several questions about MVM supplementation remain unanswered. Why do people start and continue taking MVMs? Can these supplements improve health outcomes throughout life, or are their benefits limited to certain age groups? Most research focuses on older populations, leaving a gap in understanding their effects on younger individuals. Additionally, studies like PSH II and COSMOS used Centrum Silver, making it difficult to apply findings to other MVM products. It's also unclear whether cognitive benefits are due to specific vitamins, minerals, or other compounds within MVMs. Furthermore, these studies didn't compare MVMs to a healthy, balanced diet, raising questions about whether similar benefits could be achieved through dietary improvements alone. The potential for precision dosing tailored to individual needs and whether MVMs could be included in public health guidelines or targeted supplementation strategies remains unexplored. Further research is needed to address these uncertainties and refine our understanding of the role MVMs play in promoting cognitive health and overall well-being.

Conclusion

While MVM supplements may offer some cognitive benefits, particularly for older adults, their role in promoting long-term health remains complex and not fully understood. The modest improvements observed in studies like the COSMOS study suggest that MVMs could be a valuable component of a broader strategy for maintaining cognitive health, especially where dietary intake may be inadequate. However, MVM supplementation should not be viewed as a substitute for a balanced, nutrient-rich diet or healthy lifestyle practices.

The current body of evidence indicates that MVMs are not a universal solution for everyone. Their use should be personalised, considering individual dietary needs, health conditions, and potential interactions with medications. As research continues to evolve, a more nuanced understanding of the specific benefits, risks, and appropriate contexts for MVM use will be essential. Until then, the emphasis should remain on achieving nutritional adequacy through diet, with MVMs considered a complementary option when specific needs arise.

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