

Background

Multivitamin-and-mineral (MVM) supplements are the most frequently used dietary supplements among military personnel.^{1,2} The contents of MVM supplements vary considerably, but most contain around 18 vitamins and minerals, providing up to 100% of the DV (daily value) of each.³ While there is no official definition of an MVM, an NIH panel assessing these products in 1996 defined them as “any supplement containing three or more vitamins and minerals but no herbs, hormones, or drugs, with each component at a dose less than the tolerable upper level determined by the Food and Nutrition Board—the maximum daily intake likely to pose no risk for adverse health effects”.⁴ Supplements that provide vitamins and minerals in quantities greatly exceeding those required by healthy individuals—sometimes by an order of magnitude⁵—are referred to as megavitamin-and-mineral (MMVM) supplements. The Institute of Medicine’s Food and Nutrition Board has gathered information on 35 vitamins and minerals in the process of developing its Dietary Reference Intakes (see Food and Nutrition Board DRIs below).

Dose Range and Upper Limit

Food and Nutrition Board DRIs^{3,6}

RDA/AI & Upper Limit:			
	RDA/AI Men 19-50	RDA/AI Women 19-50	Upper Limit (UL)
Vitamins			
Vitamin A (mcg)	900	700	3000
Vitamin C (mg)**	90	75	2000
Vitamin D (mcg / IU)	15 / 600	15 / 600	100 / 4000
Vitamin E (mg / IU)**	15 / 22.4	15 / 22.4	1000 / 1500
Vitamin K* (mcg)	120	90	ND
Thiamin (mg)	1.2	1.1	ND
Riboflavin (mg)	1.3	1.1	ND
Niacin (mg)	16	14	35
Pantothenic acid (mg)	5*	5*	ND
Vitamin B6 (Pyridoxine) (mg)	1.3	1.3	100
Biotin (mcg)	30*	30*	ND
Folic acid (mcg)	400	400	1000
Vitamin B12 (mcg)	2.4	2.4	ND
Choline * (mg)	550	425	3500
Carotenoids	Recommended only for people at risk of vitamin A deficiency		

*Includes classification and discussion of mega-vitamin-and-mineral supplements (Class 6).

Minerals			
Arsenic	Should not be added to any food or supplement		
Boron (mg/d)			20
Calcium (mg/d)	1000	1000	2500
Chromium (mcg)****	35	25	ND
Copper (mcg/d)	900	900	10,000
Fluoride (mg/d)*	4	3	10
Iodine (mcg/d)	150	150	1100
Iron (mg/d)	8	18	45
Magnesium (mg/d)	400-420	310-320	350
Manganese (mg/d)*	2.3	1.8	11
Molybdenum (mcg/d)	45	45	2000
Nickel (mg/d)			1.0
Phosphorus mg/d	700	700	4000
Selenium (mcg/d)	55	55	400
Silicon	No justification to be added to any food or supplement		
Vanadium (mg/d)	No justification to be added to any food or supplement		
Zinc (mg/d)**	11	8	40
Potassium (g/d)*	4.7	4.7	ND
Sodium (g/d)*	1.5	1.5	2.3
Chloride (g/d)*	2.3	2.3	3.6

*RDA not established; Adequate Intake (AI) provided ** See also Antioxidants monograph ***See also Vitamin B Complex monograph

****See also Chromium monograph

The safe upper limits (UL) for chronic intake of vitamins and minerals by military personnel are equivalent to those established by the Institute of Medicine's Food Nutrition and Board for healthy civilian adults.⁵ The ULs for most vitamins and minerals include intake from food, water, and/or supplements. However the ULs for vitamin E, niacin, and folate apply only to amounts consumed from supplements and fortified foods; magnesium from supplements (intakes from pharmacological agents only); and the UL for vitamin A includes only that consumed as retinol.⁷

Doses Used In Randomized Clinical Trials: Due to the number of substances covered here, details are not provided in this monograph. Both the Natural Medicines Comprehensive Database and the DRI reports for vitamins and minerals provide extensive information with respect to clinical trials and doses used therein.⁸

Toxicology Data: Again, due to the number of substances involved, details of toxicology are not provided here. In general, many vitamins are well tolerated, although there have been some issues identified. Minerals, however, are more likely to cause problems when consumed in excessive amounts; again, the DRI reports and the NMCD provide extensive information on toxicity. The best advice is to make sure that multivitamins do not significantly exceed the RDA and AI values available and never exceed the established ULs.

Evaluation of Potential Benefits

Multivitamin-and-mineral supplements are commonly consumed to ensure against dietary inadequacies⁹ and to promote general health.⁵ Solid evidence regarding the ability of dietary MVM supplements to improve health and prevent chronic disease is lacking.⁵ Certain micronutrient deficiencies (e.g., B-vitamins, antioxidants, vitamin D, calcium, iron, zinc, and magnesium) are associated with impaired health and physical performance.¹⁰

Consuming MVMs may help prevent micronutrient deficiencies, particularly during times of increased need such as during in-

tense physical activity or stress, during negative energy balance (e.g., during some military operations or while losing weight),⁷ and for those consuming an unbalanced diet (e.g., low fruit or vegetable intake).

Megavitamin and megamineral therapies may help treat certain disease states (e.g., malabsorption—the reduced ability to absorb dietary nutrients), particularly where a disease results in a deficiency.^{4,11} However, it does not appear that consuming megadoses of vitamins or minerals provides any health or performance benefit to healthy individuals.

Potential Detrimental Effects on...

Military Performance: No adverse effects on military performance have been documented following either acute or chronic supplementation. However, consuming MVMs or MMVMs, particularly in conjunction with other dietary supplements or fortified foods, may result in micronutrient intakes above the ULs.

Military Survivability: As above, but see also Other Health Risks and Interactions below.

Other Health Risks

Chronic overconsumption of certain vitamins or minerals could compromise an individual's physiological and psychological capabilities or compromise absorption of other micronutrients; e.g., excess vitamin B6 may result in neuropathy, a type of nerve damage; vitamin A in hepatotoxicity, a type of liver damage; and vitamin D in hypercalcemia, excess calcium in the blood.¹¹ In addition, an excess of calcium or zinc could reduce transport of iron across the gut.¹² Some evidence suggests that beta-carotene supplements may increase the risk of lung cancer in smokers.⁴ MMVMs obviously bear a higher risk of such problems due to the greater amounts of their components.

Interactions with Medications or Other Bioactive Substances

Although multivitamin products contain ingredients that may interact with many medications, interactions are unlikely for MVMs with ingredients at or below the DRIs. However, it could be a problem with MMVMs. The Natural Medicines Comprehensive Database³ and the [University of Maryland Medical Center website](#) both have extensive information on interactions for many vitamins and minerals. The DRI reports for vitamins and minerals also include extensive information on interactions. Although severe problems from using MVMs and even MMVMs are rare, it is recommended that patients taking medications consult with a healthcare professional before starting any dietary supplements.

Concern and Benefit Estimate (see Dietary Supplement Risk Matrix)

Benefit potential: Moderate (multivitamins) and Low (megavitamins)

Safety concern: Minimal (multivitamins) and Low (megavitamins)

Numeric score: **3** (multivitamins) and **6** (megavitamins)

There is no data to suggest that consuming megadoses of vitamins or minerals provides any health or performance benefit to healthy individuals, provided dietary intake is adequate, and high doses of many vitamins and minerals can have adverse effects.

References

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