

AIS SPORTS SUPPLEMENT FRAMEWORK

MULTIVITAMIN SUPPLEMENTS



What is it?

- > Vitamins and minerals are necessary for a broad range of essential chemical reactions in the body, including those involved in energy metabolism, cell growth and repair, protection from free radical damage, and nerve and muscle function. Inadequate intake of vitamins and minerals leading to a body or tissue deficiency, will impair the athlete's health and performance.
- > Athletes who restrict their total energy intake or lack dietary variety are at risk of an inadequate intake of vitamins and minerals.
- > There is no evidence that supplementation with vitamins and minerals enhances performance except in cases where a pre-existing deficiency exists.

What does it look like?

In general, the composition and concentration of ingredients contained in multivitamin (MVM) supplements vary significantly across different brands and products. Typically, MVMs contain a host of essential vitamins and minerals, in various doses, to supplement the diet. These formulations may range from basic combinations of vitamins like A, C, D, and E, along with minerals such as calcium, iron, magnesium, and zinc, to more complex products that include antioxidants, amino acids, and herbal extracts. To demonstrate the vast variability across products, the formulation of five common MVM products in Australia are shown below in **Table 1**.

Table 1. Mean \pm SD of common ingredients across five Australian multivitamin products, A: Centrum Advance - Adults, B: Berocca Energy - Effervescent Tablets, C: BioCueticals Multi Essentials, D: Swisse Men's Multivitamin, E: Swisse Women's Multivitamin

Formulation	Mean	\pm SD	A	B	C	D	E
Betacarotene (mg)	2.0	1.4	1.8		4.0	1.0	1.0
Vit D3 (μ g)	16.9	10.7	15.0		2.5	25.0	25.0
Vit K1 (μ g)	28	4	25		30		
Vit B5 (mg)	52.7	34.2	10.9	23.0	91.6	69.0	69.0
Vit B1 (mg)	22.2	17.5	2.2	15.0	50.0	22.0	22.0
Vit B3 (mg)	63	78	15	50	200	25	25
Vit B12 (mg)	25.6	17.7	3.2	15.0	50.0	30.0	30.0
Vit B6 (mg)	21.4	14.1	6.0	10.0	41.6	24.7	24.7
Vit B12 (μ g)	106	165	22	10	400	50	50
Vit B7 (μ g)	99	51	45	150	100	50	150
Vit B9 (μ g)	420	84	300	400	400	500	500
Vit E (mg)	45.6	27.4	50.0		82.6	24.8	24.8
Vit C (mg)	204	169	90	500	100	165	165
Calcium (mg)	84.3	70.9	200.0	100.0	58.4	21.0	42.0
Magnesium (mg)	77	37	50	100	25	105	105
Iron (mg)	4.3	1.1	5.0			3.0	4.9
Zinc (mg)	9.5	3.7	7.5	10.0	10.0	15.0	5.0
Manganese (mg)	1.7	1.2	3.5		1.0	1.2	1.2
Chromium (μ g)	24.4	21.8	35.0		50.0	6.2	6.2
Selenium (μ g)	33	15	55		26	26	26
Copper (μ g)	204	208	500		200	58	58
Iodine (μ g)	83	58	150			50	50
Potassium (mg)	29	44	80			4	4

Vit D3: Colecalciferol, Vit K1: Phytomenadione, Vit B5: Calcium pantothenate, Vit B1: Thiamine nitrate/thiamine hydrochloride, Vit B3: Nicotinamide, Vit B12: Riboflavin, Vit B6: Pyridoxine hydrochloride, Vit B12: Cyanocobalamin, Vit B7: Biotin, Vit B9 : Folic Acid, Vit E: dl-alpha-tocopheryl acetate, Vit C: Ascorbic acid, Calcium: Calcium carbonate/calcium hydrogen phosphate/calcium pantothenate/calcium citrate tertahydrate, Magnesium: Magnesium oxide, Iron: Ferrous fumarate, Zinc: Zinc oxide/amino acid chelate/zinc sulfate monohydrate, Manganese: Manganese sulfate monohydrate/amino acid chelate, Chromium: Chromic chloride hexahydrate/chromium nicotinate/chromium picolinate, Selenium: Sodium selenate/selenomethionine, Copper: Cupric sulfate/copper gluconate, Iodine: Potassium iodide, Potassium: Potassium sulfate.

How and when do I use it?

There are numerous mechanisms of action by which the specific ingredient of a MVM could be efficacious for use in athletes (for review see Beck et al., 2021 and Peeling et al., 2023). However, these benefits apply only to specific vitamins and minerals found in common MVMs and are generally observed when the nutrient is consumed in isolation, often at doses higher than those found in MVMs. Accordingly, there is little evidence to suggest that any given MVM can have a significant impact on these outcomes. Regardless, the potential mechanisms of action relevant to the above mentioned 'benefits' can be summarised as:

1. **Nutrient Replenishment:** The demands of training may increase the vitamin and mineral requirements of athletes. Accordingly, MVMs may provide a source of nutrient in a compact format, particularly for athletes with poor dietary habits, inadequate time for refuelling, or restrictive diets (i.e., vegetarian, vegan, etc.).

2. **Immune System Support:** High training loads can temporarily suppress the immune system. Research shows that vitamins C, D, and E, may help support immune function, potentially reducing the risk of illness in athletes.
3. **Energy Production and Red Blood Cell Function/Production:** B vitamins and iron play crucial roles in energy metabolism and red blood cell function/production. Supplementation with B vitamins and iron may support energy levels, oxygen transport, and haematological adaptation.
4. **Bone Health:** Vitamins D and K, along with calcium and magnesium, contribute to bone health. Healthy levels of these vitamins and minerals may help reducing the risk of bone-related injury.
5. **Recovery and Adaptation:** Antioxidants such as vitamins C and E may help mitigate the impact of oxidative stress from intense exercise. Further, vitamins A and C are involved in important recovery processes such as collagen synthesis for tissue repair. Therefore, adequate levels of vitamins and minerals are important for athlete recovery/adaptation to training.

In general, vitamin and mineral supplementation provided to an athlete on a well-balanced diet does not typically improve performance. However, it is well-established that a vitamin or mineral deficiency can impair physical performance, which if corrected, can positively improve performance (Williams, 1989).

In general, athletes are typically poor at servicing their energy intake requirements, and therefore, certain situations (i.e., food restricted diets, poor recovery timing and nutrition, etc.) may warrant an athlete to consider a vitamin or mineral supplement to meet their daily need. However, MVMs should only be consumed to augment an athlete's typical diet (Peeling et al., 2023).

Given there are numerous vitamins and minerals of importance to athletes, each having specific relevance to certain situations, the usefulness of an MVM to correct a specific deficiency is questioned, and practitioners should consider potential emphasis on the specific nutrient of need to help fix an identified issue (Peeling et al., 2023).

Are there any concerns or considerations?

There is limited scientific evidence for the beneficial use of MVMs to enhance athlete performance, primarily because a well-balanced diet, of sufficient energy intake and nutrient composition, can prevent the need for MVM use. Further, there are a myriad of formulations available on the market, which makes testing any single product's efficacy difficult. Finally, if a known nutrient deficiency exists, the low dose of each vitamin and mineral in an MVM to address a specific nutrient problem makes their targeted use limited, whereby a specific focus on the nutrient of need would be more effective (i.e., using an iron supplement to target an iron deficiency rather than an MVM). Accordingly, limitations to the current evidence for MVM use can be summarised as:

1. **Limited evidence of performance enhancement in individuals who are not nutrient deficient.**
2. **Megadose products may be counterproductive.** Large doses of antioxidant vitamin supplements (e.g. Vitamins C and E) may be counterproductive if they upset the balance of the body's complex antioxidant system. In some cases, such supplementation has been shown to impair the effectiveness of training by dampening the oxidative pathways that are needed to signal the adaptive response to an exercise session (Merry et al 2016)
3. **Poor replacement of targeted micronutrient therapy.** Multivitamin mineral supplements do not replace the potential need for the supervised treatment or prevention of deficiencies of key micronutrients (e.g. iron deficiency). Athletes who are at high risk of such a deficiency should seek the advice of a Medical Practitioner or Accredited Sports Dietitian rather than self-medicate.
4. **Negative nutrient interactions** (i.e., co-consumption of calcium and iron can reduce the absorption of iron).
5. **Inadvertent ingestion of banned or harmful substances.** Although all sports foods and supplements can be a source of contaminants or undeclared ingredients, the current positioning of vitamin and mineral supplements as a "pick me up" or lifestyle tonic merits particular caution. We note that some products contain herbal ingredients or other forms of stimulants that are included to give a sense of "energy" - these may lead to health concerns or an inadvertent Anti-Doping Rule Violation.
6. **Vitamin and mineral supplements are often considered a replacement for a poor intake of fruits and vegetables.** However, they do not contain the huge variety of phytochemicals found in fruits, vegetables, herbs, and spices that promote health-related effects.
7. **Accumulation of excessive and unnecessary doses.** Many athletes consider vitamins and minerals to be a "pick me up" in times of heavy training or fatigue. They may add a multivitamin mineral supplement (or two) to their existing use of supplements and sports foods, some of which are already fortified with the same ingredients. The combination of many different sources can lead to unnecessarily high intakes of some micronutrients with unwanted side effects including toxicity or competition for absorption between nutrients.
8. **Risk of peripheral neuropathy.** Multivitamin supplements often have added Vitamin B6, which has been associated with peripheral neuropathy, a type of nerve damage that causes tingling, burning or numbness in the hands and feet. While the maximum permitted daily dose in individual supplements is 100mg, Vit. B6 is added to a large number of supplements, including multi-vitamin and mineral supplements, electrolytes, plus mineral complexes like magnesium and zinc. Peripheral neuropathy can occur at doses of Vit. B6 <50mg. Talk to your sports dietitian if you have any concerns about the supplements you are using and chat to your doctor if you have any questions about peripheral neuropathy.

Where can I find more information?

Sports Dietitians Australia www.sportsdietitians.com.au/factsheets

Supplement safety information www.sportintegrity.gov.au/what-we-do/anti-doping/supplements-sport

References

1. Beck, K. L., von Hurst, P. R., O'Brien, W. J., & Badenhorst, C. E. (2021). Micronutrients and athletic performance: A review. *Food and Chemical Toxicology*, 158, 112618. <https://doi.org/10.1016/j.fct.2021.112618>
2. Merry, T. L., & Ristow, M. (2016). Do antioxidant supplements interfere with skeletal muscle adaptation to exercise training? *The Journal of Physiology*, 594(18), 5135-5147. <https://doi.org/10.1113/JP270654>
3. Peeling, P., Sim, M., & McKay, A. K. A. (2023). Considerations for the consumption of vitamin and mineral supplements in athlete populations. *Sports Medicine*, 53(Suppl 1), 15-24. <https://doi.org/10.1007/s40279-023-01774-6>
4. Williams, M. H. (1989). Vitamin supplementation and athletic performance. *International Journal for Vitamin and Nutrition Research Supplement*, 30, 163-191.

The Australian Institute of Sport (AIS) Supplement Framework is an initiative of the Australian High Performance Sport System. The AIS acknowledges the support of members of the National Institute Network (NIN) and National Sporting Organisations (NSO) and their staff in delivering content expertise. This information is intended to help athletes, coaches and scientists make evidence-based decisions about the use of supplements and sports foods. Before engaging in supplement use, we recommend that each individual refer to the specific supplement policies of their sporting organisation, sports institute or parent body, and seek appropriate professional advice from an accredited sports dietitian (www.sportsdietitians.com.au).

Athletes should be aware that the use of supplements may have doping implications. Athletes are reminded that they are responsible for all substances that enter their body under the 'strict liability' rules of the World Anti-Doping Code. Some supplements are riskier than others. The Sport Integrity Australia (SIA) app is a useful resource to help mitigate the risk of inadvertent doping by helping to identify supplements that have been batch-tested. The SIA App provides a list of more than 11,000 batch-tested products. We recommend that all athletes consult the educational resources of SIA regarding the risks associated with supplements and sports foods. While batch-tested products have the lowest risk of a product containing prohibited substances, they cannot offer you a guarantee that they are not contaminated (www.sportintegrity.gov.au/what-we-do/supplements-sport).