Vegan Multivitamin and Mineral Formula (VMVM)

Goal

To supply non-animal forms of vitamins and minerals (VM) in amounts complementary to nutritional gaps commonly found in typically consumed vegan diets when compared to current recommended dietary allowances (RDAs) or recommended levels of nutrients and other important bio-actives. Filling the inadvertent nutritional gaps left from food alone and/or increased by activity, supports the body VM dependent activities as opposed to adapting to often unavoidable dietary limitations or choices. The added supply of nutrients without the calories also helps control healthy desired body composition while simultaneously contributing to recommended nutrition levels. The VMVM is designed to work synergistically with the typical vegan or vegetarian's food intake to reach these levels associated with good health including healthy aging. The formula is ideal for the vegan seeking to support healthy longevity by ingesting a superiorly formulated (Practitioner Product) multivitamin and mineral dietary supplement (MVM) when compared to the typical under-formulated mass market MVM products. *See the previous opening section, dotFIT Multivitamin and Mineral for formulation and manufacturing differences in mass market ingredient forms, delivery systems, etc. including references.*[1]

Rationale

See the section of the dotFIT Practitioner Dietary Supplement Reference Guide (PDSRG) on Multivitamin and Mineral Formulas & ActiveMV *for the rationale for all persons to include a daily MVM formula.*

Vegan Formula

Vegan is a form of vegetarianism that prohibits the consumption of animal products.[2] Veganism has been on the rise in the general population including athletes (at least claiming veganism) for reasons such as allergies, environmental protection and nutrition, animal welfare, health, religious or cultural norms.[3,4] As with any modern day diet regimes that restrict certain foods natural to the evolution of our species, without careful attention to diet details, vegans fall short of an often different set of nutrients than the omnivore or different groups of vegetarians (see vegetarian categories below in Table 1 from Rogerson).[4,5,6,7,8] Macronutrient concerns of a vegan diet are generally the ability of plant foods to deliver adequate complete protein under all conditions[9] (e.g. ageing, athletic endeavors including dieting to "make weight" or body fat requirements, etc.), which can be compensated for by properly combining foods and the use of plant based protein supplements as necessary.[10,11,12] Potential micronutrient shortages in a vegan diet may be of particular concern for athletes and regular exercisers.[4] Without regular consumption of animal derived food sources including fortified sources, vegan micronutrient shortages of concerns are generally vitamin D and B12, zinc, calcium, iodine and iron.[4,5,6,7,8,13,14] Table 2, from Rogerson with related references from his article: "Vegan Diets: Practical Advice for Athletes and Exercises," lists the different diets and potential shortcoming for the athlete.

Micronutrients

B12

Among other functions, B12 (cobalamin) is essential to nervous system function and DNA synthesis.[15] Regular insufficient intake leads to physical and cognitive weaknesses and veganism often leads to deficiencies without supplementation.[16] Plant based sources of cobalamin are almost non-existent.[14] Humans consume cobalamin from animal products, as animals manufacture pre-formed cobalamin in their rumens (intestines) and consumption transfers a usable form of B12 to the consumer. Like food sources of B12, supplement sources are poorly absorbed.[17] Absorption is limited by the presence of intrinsic factor (glycoprotein) as it needs to bind with ingested B12 to facilitate its absorption into the body. In fact, a dietary supplement of 500 µg may only end up delivering 10 µg into the body. The RDA for B12 is 2.4µg/d[18] but it's often recommended that vegans may need up to 6 µg/d through supplements in order to achieve adequate levels.[4,19]

Table 1 Vegetarian Diets: Definitions

Type[a]	Description
Flexitarian[b]	Occasionally consumes animal flesh (meat, poultry) and fish, eggs, dairy
Pesco-vegetarian	Excludes animal flesh but does include fish
Lacto-ovo vegetarian	Excludes all flesh; includes diary and eggs only
Lacto vegetarian	Excludes all flesh and eggs; includes dairy only
Ovo vegetarian	Excludes all flesh and dairy; includes eggs only
Vegan	Excludes all animal products
Macrobiotic vegetarian[b]	Variable dietary restrictions; includes wild meat/ game and fish in some variations of the diet
Fruitarian	Includes fruit, nuts, seeds and a some vegetables

[a]Definitions from Phillips 2004 [14]
[b]Readers are advised to exercise caution in their interpretation of Flexitarian and Macrobiotic diets as vegetarian diets; owing to their selective inclusion of meat, poultry, fish and seafood, such diets might not be truly vegetarian

Iron

Iron has many functions in the body, with its role in oxygen transport (constituent of oxygen binding proteins hemoglobin and myoglobin), ATP production (component of the respiratory complex I) and keeping highly reactive oxygen-containing molecules in check (free radical metabolism such as that through superoxide dismutase) being at the head of the list, especially for athletes and exercisers since iron insufficiency would lead to a significant reduction in energy potential.[4] The primary form of iron in the vegan diet is from plants or nuts, referred to as nonheme iron (NHI).[20] NHI is not nearly as bioavailable as animal derived heme iron for the same reasons as described under B12, in that the animal converts the NHI to the more usable heme iron (HI) for humans. [21,22,23] When we consume the animal product, we get the HI form in which 15-35% is absorbed compared to only 2-20% of NHI.[21,22,23] All this said, as with other micronutrients, humans can adapt to a wide range of iron intakes by increasing intestinal absorption and decreasing excretion during times of low iron status as determined by blood concentrations.[6,24,25] Notwithstanding the aforementioned, the Institute of Medicine (IOM) suggests that iron requirements for vegetarians should be ~80% higher than the RDA, bringing the recommendation to 14 mg/d for males and 33 mg/day for females (RDA is 8 and 18 mg/d). In Rogerson's article "Vegan Diets: Practical Advice for Athletes and Exercises," he suggests Vegan athletes consume nonheme iron rich foods (e.g. legumes/nuts/seeds, green vegetables such as spinach, etc.) in conjunction with vitamin C since vitamin C enhances iron absorption.[4] These athletes should concurrently avoid consuming iron inhibiting substance such as coffee, tea, cocoa and high phytate containing grains.[26]
All considered including the Upper Limit (UL) for iron intake being 45 mg/d, the dotFIT Vegan MVM contains 15 mg of nonheme iron (ferrous fumarate) along with 200 mg of vitamin C (vegans tend to get more vitamin C from the diet than omnivores) therefore, guaranteeing synergistic ingestion and both doses complementary to typical vegan diet intake.[7,27]

Calcium

Most Americans (western diet consumers) fall short on calcium needs from diet alone, but calcium intake is of particular concern for vegans since dairy is the richest source. [28,29] It has been shown that vegans get ~50% of their calcium needs from diet (slightly less than 600 mg/d vs. RDA of 1,000-1,200 mg/d).[4,30] Validation of the vegan's chronic low intake of calcium manifests in the fact that vegans have been shown to have an increased fracture rate compared to others.[31] Therefore, unless corrected through diet (high consumption of calcium containing vegetables such as broccoli, kale, etc.), most vegans would need to take a separate calcium supplement because the amount necessary to fill the void would be too large to put into a single MVM tablet. The same is true for omnivores but they tend to ingest 50% more calcium than the vegan.[30,32] However, this still requires a separate supplement based on an acceptable single pill size. Therefore, none of the dotFIT MVM formulas including the Vegan MVM contains calcium, and consumers in need are recommended to take a separate complete calcium supplement that includes the cofactors necessary to facilitate proper functional absorption such as the dotFIT SuperCalcium+ and remain synergistic with the accompanying MVM. Note that dotFIT's SuperCalcium+ is vegetarian friendly and serves as a reference for a properly formulated calcium supplement for vegans seeking a similar product.

Vitamin D

The Task Force for the Clinical Guidelines Subcommittee of The Endocrine Society[33] has suggested that to maximize the effect of vitamin D on calcium, bone, and muscle metabolism, serum 25(OH)D concentrations should exceed 75 nmol/L (>30 ng/mL). [34,35,36,37,38] The same task force suggests <50 nmol/L (20 ng/mL) characterizes vitamin D deficiency.[33] Therefore, vitamin D concerns for the vegan are the same (albeit slightly amplified based on diet omissions) as for the general population in achieving the newer recommendation for adequate blood levels. In other words, it would be difficult if not impossible to achieve these 25(OH)D levels without year-round sun exposure or finding other fortified foods since natural sources of vitamin D are scarce. In fact, without fatty fish or dairy (fortified milk), one would find diet alone, without vitamin D fortified foods, unable to deliver the vitamin D necessary to achieve modern levels associated with greater overall health.[34,35,36,37,38,39,40]

The Vegan MVM contains 2000 IUs of vitamin D2, ergocalciferol, (1,000 more IUs than the other dotFIT MVM formulas). D3 (cholecalciferol), in all other dotFIT MVMs, is more bio-available but is not considered vegan-friendly[41] and therefore 2000 IUs easily compensates for less functional conversion availability or half- life.[42] Often an *additional* separate high dose vitamin D supplement may be warranted to reach newer recommendations listed above beyond the Institute of Medicine's recommendation for bone health.

Zinc

Zinc is an essential mineral as it serves as a co-factor (constituent) of hundreds of enzymes and crucial for the accurate replication and role of DNA.[43] Insufficiencies, which are common throughout the world, can lead to less zinc dependent activities effecting gene expression, oxidation defenses, wound healing, synaptic signaling, taste, immune function, growth and appetite just to name a few of the body's systems affected by low levels of zinc.[44,45] It's been reported that up to a 1/3 of the world's population may be deficient in zinc with a higher number in the U.S. being insufficient.[32,46,47]

As with other minerals discussed here such as iron, plant sources of zinc have weak bioavailability but at the same time, the body appears to adapt to low functional levels by increasing absorption and minimizing loses.[6] The other issue in achieving proper levels of zinc is the phytate (phytic acid) content in the plant foods (e.g. seeds, nuts, grains, cereals, legumes, etc.) that contain zinc and other minerals. Phytic acid is part of the hulls of seeds, including nuts, grains and beans and has a strong binding affinity to important minerals, such as calcium, iron, and zinc. [48,49] When zinc and iron are bound with phytic acid, they become insoluble particles, thus far less absorbable in the gastrointestinal (GI) tract.[48] This problem can lead to iron and zinc deficiencies in people whose diets rely primarily on these phytate containing foods to achieve sufficient zinc levels.[48,50] Due to the aforementioned, the IOM recommends

that vegans consume ~50% more zinc than non-vegetarians, which puts males up to ~16.5 mg/d and females up to 12 mg/d (RDA is 11 and 8 mg/d respectively).[43]
Mindful that the upper limit (UL) for zinc intake is 40 mg/d, the dotFIT Vegan MVM contains 15 mg, making it an ideal complement to the typical vegan diet.[43]

Iodine

Iodine is an essential constituent of the thyroid hormones and therefore has a powerful impact on growth, development and metabolism.[51] Iodine is necessary for the enzymes responsible for thyroid hormone synthesis.[52] Best food sources of iodine are marine fish, seaweed (not necessarily reliable source for accurate intake based on variability[53]), shellfish and sea salt. Unfortified iodine content in foods and water depends on the iodine content of the soil in the region of origin, with iodine depleted soil yielding only a fraction compared to plants grown in iodine sufficient soil, which may contain ~1 µg of iodine/g of dry weight.[51,52,54]
Iodine requirements are ~150 µg/d with slightly more needed in pregnancy and lactation. Intake above requirements in healthy people show no benefits, nor harm if below 2,000 µg/d.[55] Based on all the above, the dotFIT Vegan MVM contains 100 µg to complement the vegan diet in achieving at least 150 µg/d including the variables of seaweed consumption or plant soil iodine content accuracy.[56]

Table 2 - Different Diets and Potential Shortcomings[4]

Diet type	Possible dietary Issues[a]	Possible sport-related issues[a]	Recommendations[b]
Omnivorous	Poor ad libitum diets can lead to nutrient deficiency. Vitamin D deficiency possible (if sun exposure is poor / unlikely).	Male and female athletes with low energy intake at risk of nutrient deficiencies. Calcium requirements increased during negative energy balance, amenorrhea and female athlete triad.	Energy intake should be scaled to activity level. Depending on sport, 1.4–2.0 g · kg^{-1} protein; 3–10 g · kg^{-1} CHO; 0.5–1.5 g · kg^{-1} fat (or, 30% energy) consumed daily. Micronutrient-rich diet sufficient to achieve DRVs; Vitamin D3 supplement might be necessary.
Pesco-vegetarian	Same as omnivores plus: Energy[c], protein.	Iron deficiency with and without anaemia a risk in female athletes.	Same as omnivores, plus ensure that iron needs are met via a variety of food sources.
Lacto-ovo vegetarian & Lacto-vegetarian	Same as pesco-vegetarians plus: Long chain *n*-3 (EPA, DHA), iron, zinc, riboflavin deficiencies more likely.	Same as pesco-vegetarians plus: Reduced muscle creatine and carnosine stores a possibility in males and females.	Same as pesco-vegetarians plus: EPA / DHA supplement (total 1–2 g · day^{-1}; 2:1 ratio) might be needed. Increase iron (m = 14 mg & f = 33 mg · day^{1}) and zinc (16.5 mg & 12 mg · day^{1}) intakes due to reduced bioavailability of plant sources.
Vegan	Same as vegetarians plus: Protein, fat, *n*-3, B12, calcium, iodine deficiencies also possible / likely in males and females.	Same as vegetarians plus: Low bone-mineral density is an increased possibility in female athletes. Achieving energy balance might be a problem for larger athletes.	Same as vegetarians plus: Increase protein to 1.7–2.0 g · kg^{-1} and up to 1.8–2.7 g · kg^{-1} during weight loss phases (obtain from range of plant-based foods). Nuts, seeds, avocados, oils to achieve 0.5–1.5 g · kg^{-1} fat daily. EPA / DHA (microalgae); vitamin D3 (lichen) & B12 supplements might be needed; iodine in some instances too. 1000 mg · day^{-1} calcium from beans, pulses, fortified foods and vegetables.

[a]Data from various sources [8–11, 13, 14, 23–25, 47, 63, 70, 87]
[b]Recommendations from various sources [9–11, 16, 17, 22, 47]
[c]Energy balance a potential issue in endurance, weight-making and aesthetic sports and larger athletes regardless of diet [15]

Typical Use

- People practicing veganism and/or vegetarians, to support common dietary insufficiencies based on food choices alone
- One tablet per day immediately after first main meal

dotFIT multivitamin and mineral formulas are considered safe for the general population at the proper dosage. Given the risk to benefit ratio, the long-term use of dotFIT multivitamin and mineral formulas is much safer than consuming the typical American diet without nutrient augmentation.[57,58]
For more info on dotFIT MVMs, including purpose and unique features; potential precautions, contraindications, upper limits and adverse events, see the *dotFIT Multivitamin and Mineral section* Multivitamin and Mineral Formulas & ActiveMV (pages 6-7).

dotFIT Vegan Products

- Vegan MVM
- SuperiorAntioxidant™
- UltraProbiotic™
- WeightLoss & LiverSupport™
- CarbRepel®
- ThermAccel™
- MuscleDefender™
- CreatineXXL™
- Creatine Monohydrate - Raspberry Lemonade
- NO7Rage™
- Best Plant Protein – Chocolate
- Best Plant Protein – Vanilla
- DigestiveEnzymes
- Vegan AminoBoostXXL

Supplement Facts Panel

SUPPLEMENT FACTS

Serving Size: 1 Tablet
Servings Per Container: 60

	Amount Per Serving	% Daily Value
Vitamin A (as Beta Carotene)	6000 mcg (10000 IU)	667%
Vitamin C (from Magnesium Ascorbate)	200 mg	222%
Vitamin D-2 (as Ergocalciferol)	50 mcg (2000 IU)	250%
Vitamin E (as d-alpha tocopheryl succinate)	82.64 mg (100 IU)	551%
Vitamin K-1 (as Phytonadione)	25 mcg	21%
Vitamin K-2 (as Menaquinone-7)	25 mcg	21%
Vitamin B-1 (as Thiamine Mononitrate)	6 mg	500%
Vitamin B-2 (as Riboflavin)	6 mg	462%
Vitamin B-3 (as Niacinamide)	20 mg	125%
Vitamin B-6 (as Pyridoxine HC1)	6 mg	353%
Folate	333mcg DFE (200 mcg folic acid)	83%
Vitamin B-12 (as Cyanocobalamin)	15 mcg	625%
Biotin	50 mcg	167%
Pantothenic Acid (as d-calcium pantothenate)	10 mg	200%
Iron (from Ferrous Fumarate)	15 mg	83%
Iodine (from Potassium Iodide)	50 mcg	33%
Magnesium (from Magnesium Ascorbate)	50 mg	12%
Zinc (from Zinc Picolinate)	15 mg	136%
Selenium (from Sodium Selenite)	50 mcg	91%
Copper (from Copper Bisglycinate Chelate)	1 mg	111%
Chromium (from Chromium Picolinate)	100 mcg	286%

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