Examine.com

Vegetarians & Vegans Supplement Guide

Written by the editors of Examine.com
Updated November 07, 2017

Medical Disclaimer

This guide is a general-health document for adults over 18. Its aim is strictly educational. It does not constitute medical advice. Please consult a medical or health professional before you begin any exercise-, nutrition-, or supplementation-related program, or if you have questions about your health.

This guide is built on scientific studies, but study outcomes are never homogeneous: individual results do vary. If you engage in any activity or take any product mentioned herein, you do so of your own free will, and you knowingly and voluntarily accept the risks. While we mention major known interactions, it is possible for any supplement to interact with other supplements, as well as with foods and pharmaceuticals.

A product may not contain the exact compounds and amounts listed on its label. Before you decide whether to take it, investigate it and its manufacturer. More than isolated compounds, herbs are prone to batch-to-batch variability, which can alter their efficacy and safety.

For evidence supporting the claims mentioned in this guide, please visit Examine.com.

Table of Contents

How to Use This Guide

The Examine.com team has been publishing research on nutrition and supplementation since March 2011. Drawing from all we've learned, we've designed this Stack Guide to help you figure out which supplements can help you reach your health goal, and which can hinder you or just waste your money.

Core supplements have the best safety-efficacy profile. When used responsibly, they are the supplements most likely to help and not cause side effects.

Primary options may provide substantial benefit, but only in the right context. A primary option is not for everyone, but if you read the entry and find that you meet the criteria, consider adding the supplement to your stack.

Secondary options have less evidence for their effects. They could work or be a waste of money. Keep them in mind, but think twice before adding them to your stack.

Promising supplements are backed by tradition or by mechanistic, animal, epidemiological, or anecdotal evidence, but not yet by convincing human trials.

Inadvisable supplements are either potentially dangerous or simply ineffective, marketing claims notwithstanding. Do not add them to your stack. At best, they'll be a waste of money; at worst, they can cause you harm.

Now that you've been presented with various supplements worthy of your interest, the time has come to combine them based on your objective. We'll guide you in **assembling your stack**.

Then comes the **FAQ**, in which we cover common questions that may arise when assembling your stack.

Lastly, we include information on **precautions and troubleshooting**.

With all this combined, you should be able to identify and assemble the supplement stack best suited to your objective.

Core Supplements

Carnitine

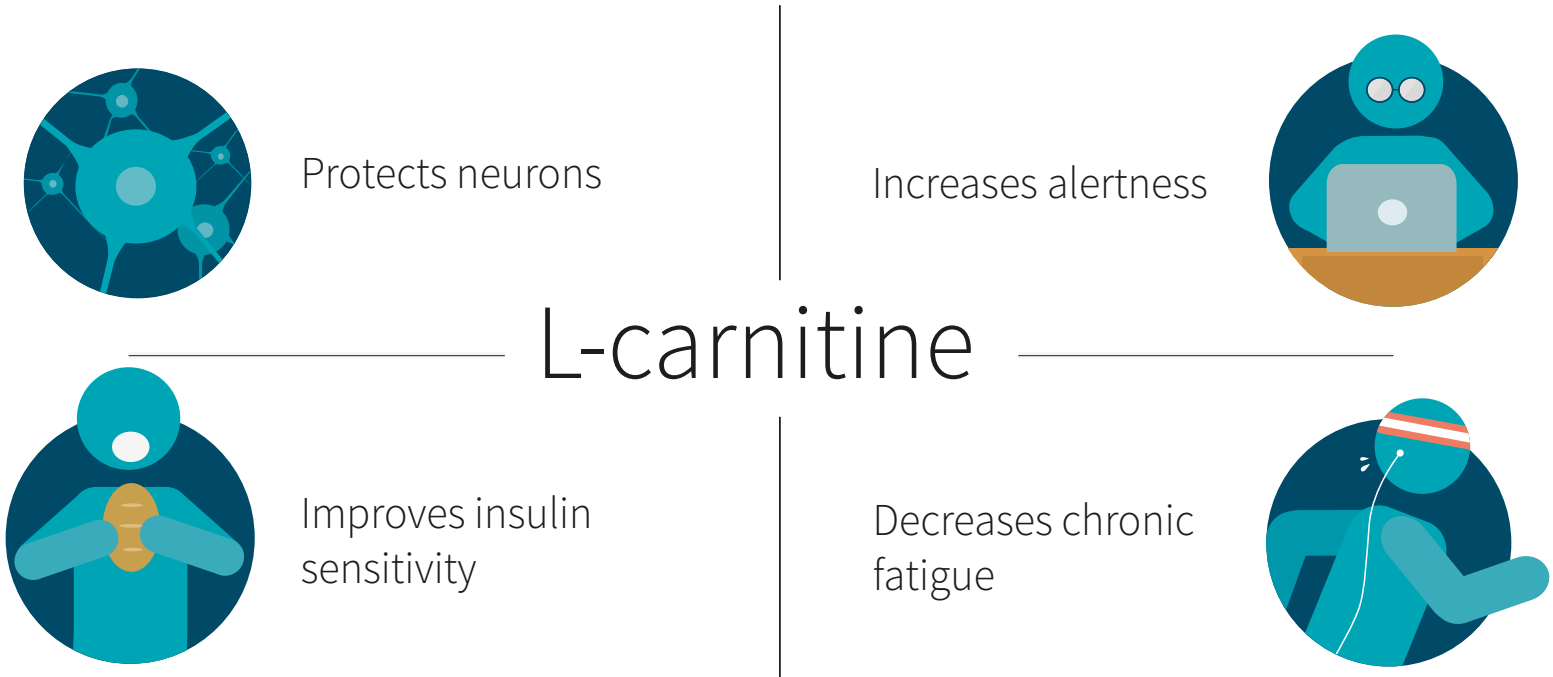
Why it's a core supplement

Compared with omnivores, vegetarians and vegans tend to live longer with healthier lifestyles, yet their diets make them more susceptible to low levels of certain beneficial compounds, notably carnitine, creatine, EPA, and DHA.

Carnitine plays a major role in cognition, energy metabolism, and cardiovascular health. Your body can synthesize it out of lysine and methionine, two other amino acids, but three-fourth of the carnitine in omnivorous people comes from the meat products they consume.

In vegans and vegetarians, carnitine supplementation can reduce muscular and cognitive fatigue. Supplemental carnitine is usually synthesized in a laboratory, not derived from an animal source, but check the label for confirmation.

Figure 1: Summary of L-carnitine's benefits



How to take it

For neurological benefits, take **acetyl-L-carnitine** (ALCAR). Start with 250 mg/day. Over the course of a week, increase to 500 mg/day. Taking ALCAR

on an empty stomach will result in more potent cognitive benefits. This type of carnitine has a tart taste, but it can be dissolved in tea or coffee and still retain its effects.

For non-neurological benefits, take 2 g of **L-carnitine** per day, with carbohydrates if you wish to increase the rate of absorption by the muscles.

Those 2 g of **L-carnitine** can be supplemented through 3 g of **L-carnitine L-tartrate** (LCLT) or **glycine propionyl-L-carnitine** (GPLC), but neither option has proven advantages over regular L-carnitine, both are more expensive, and GPLC also clumps easily in moist environments.

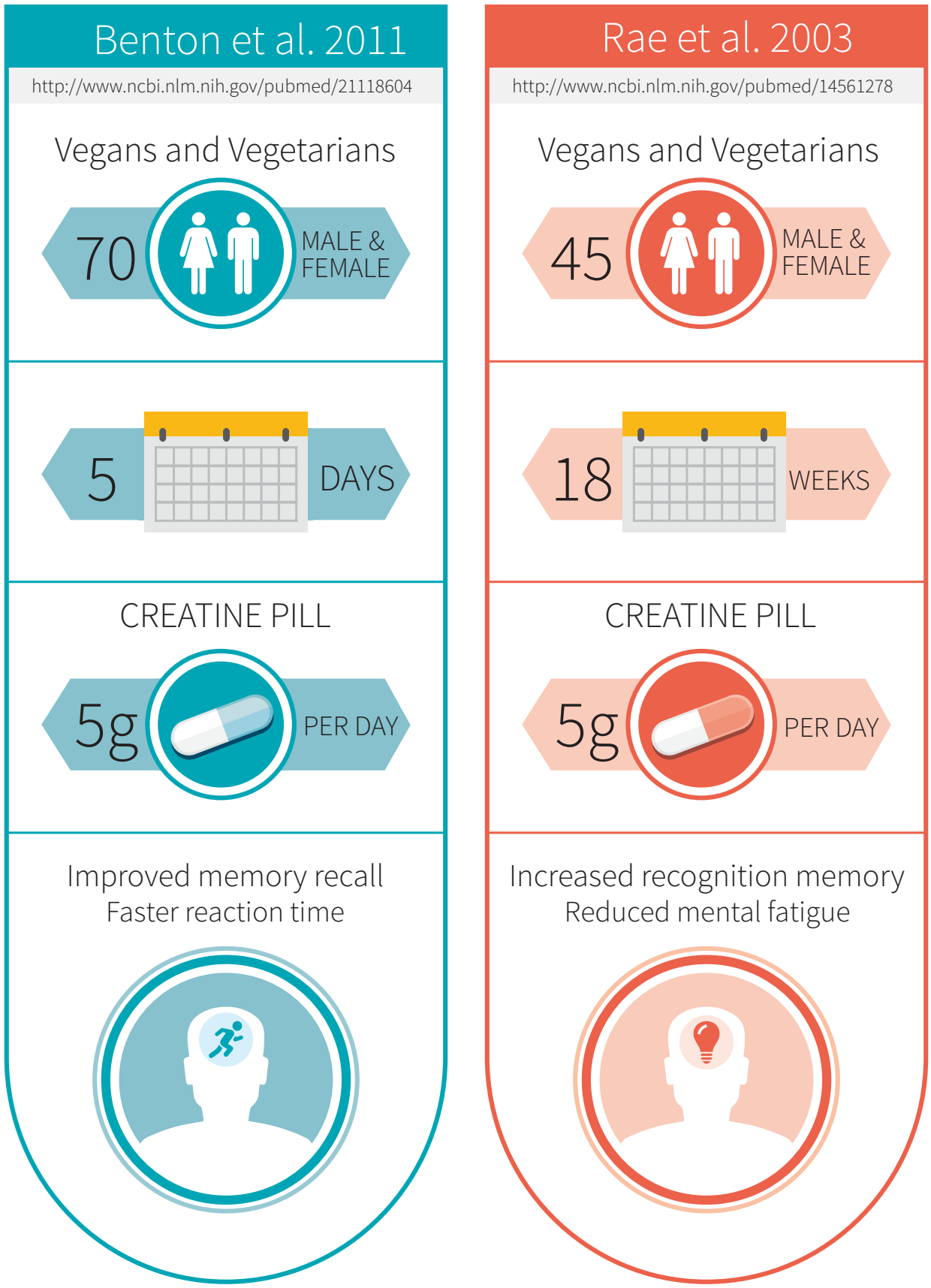
Creatine

Why it's a core supplement

Your cells use creatine to regenerate *adenosine triphosphate* (ATP), life's energy currency, before they turn to burning glucose. Enough creatine is synthesized in the liver, kidney, and pancreas to prevent any deficiency, but additional creatine can benefit power output and anaerobic endurance. It can also benefit cognition (memory formation and attention span), and this to a greater degree in vegetarians and vegans than in omnivores.

Creatine can be consumed through meat, fish, and eggs, but it can also be supplemented. Creatine supplementation is considered safe: Aside from some water retention, its only potential side-effects are nausea, stomach cramps, and diarrhea from too large a dose.

Figure 2: Evidence for cognitive benefits in vegans and vegetarians



Sources: Benton et al. *Br J Nutr*. 2011 Apr.
Rae et al. *Proc Biol Sci*. 2003 Oct.

How to take it

Once a day with a meal, take 2–5 g of **creatine monohydrate**. Other forms of creatine may be more *expensive*, but studies have not found them to be more *effective*. Should you find yourself particularly sensitive to creatine's digestive side-

effects, which include nausea and cramping, try drinking more water. You can also split your daily dose and take it with meals. Finally, you could try *micronized* creatine monohydrate, which has for other advantage to be more soluble.

Loading creatine means taking a high daily dose for a few days (e.g., 5 g five times a day for 5 days) before moving down to a smaller maintenance dose, which can be taken indefinitely. This is not necessary for effective supplementation, however; benefits may be felt sooner through loading, but they normalize after a few weeks.

Some people are creatine nonresponders: The creatine they ingest largely fails to reach their muscles. Alternate forms of creatine (such as creatine ethyl-ester) have been marketed as addressing the issue, but they lack scientific support. Currently, the best way to lessen creatine nonresponse is still to take creatine with a meal high in both protein and carbohydrate, preferably close to a time of muscle contraction (i.e., before or after your workout, if you work out).

Note that even if supplemental creatine fails to enter your muscles it can still benefit you in other ways, such as by improving your body's methylation status.

If you are not a creatine nonresponder, you need not worry about timing supplementation, though you should remember that taking your dose with a meal lowers the risk of an upset stomach. Creatine can be added to any liquid (even hot coffee or tea), but it must be drunk within the day, as creatine in liquids degrades into creatinine over time (the higher the temperature and the lower the pH, the faster the degradation). Do not buy liquid creatine products.

Omega-3 Fatty Acids

Why they're a core supplement

Essential fatty acids (EFAs) are polyunsaturated fatty acids your body needs and cannot produce. There are only two kinds of EFAs: linoleic acid (LA) and alpha-linolenic acid (ALA). Neither is very active, so your body transforms the former into notably arachidonic acid (AA) and the latter into eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). LA and AA are omega-6 fatty acids, whereas ALA, EPA, and DHA are omega-3 fatty acids.

LA and ALA compete for the same enzymes for their conversion. Too much LA means that too little ALA gets converted, and vice versa. The LA:ALA ratio in American diets is even higher for vegetarians (10–16:1) and vegans (14–20:1) than for omnivores (<10:1). Vegetarians and vegans should aim for a 2–4:1 ratio. A ratio lower than 1:1 should be avoided, since it could lead to insufficient conversion of LA to AA.

Most people could achieve a better LA:ALA ratio by increasing their intake of foods rich in ALA (including oils) and decreasing their intake of processed foods rich in LA (notably oils and snacks). A source rich in ALA can also be rich in LA, so take into account the ratio between both types of EFAs.

Table 1: Plant sources of EFAs

Oil	LA%	ALA%	LA:ALA Ratio
Flaxseed	14	53	**0.3:1**
Canola	19	9	**2:1**
Hempseed	56	18	**3:1**
Walnut	53	10	**5:1**
Soybean	51	7	**8:1**
Corn	54	1	**46:1**
Safflower	13	0.1	**133:1**
Cottonseed	52	0.2	**258:1**
Grapeseed	70	0.1	**696:1**
Sunflower (mid-oleic)	29	0.04	**782:1**

For details on more foods, consult the USDA Food Composition Database.

Even in an optimal scenario, though, conversion of ALA into EPA and DHA is very inefficient, so consuming EPA and DHA directly can have numerous health benefits. Omnivores need only eat fatty fish, but vegetarians and vegans will need to rely on algal oil softgels (algae being low in fat, eating them directly will not help much). Vegetarians who eat eggs can also get some DHA this way.

Omega-3 fatty acids have blood-thinning properties and so may potentiate other blood thinners, such as warfarin (Coumadin). They may also lower blood pressure and increase fasting blood sugar levels.

How to take them

Every day, take 650 mg of combined EPA and DHA in the form of algal oil softgels. If for some reason this is not an option, take 2–4 g of ALA through foods or oils.

Omega-3 oils should be stored in the dark. Softgels can be kept at room temperature, but opened oil bottles should be placed in a cool location (such as the refrigerator). Do not heat omega-3 oils.

Vitamin B_{12}

Why it's a core supplement

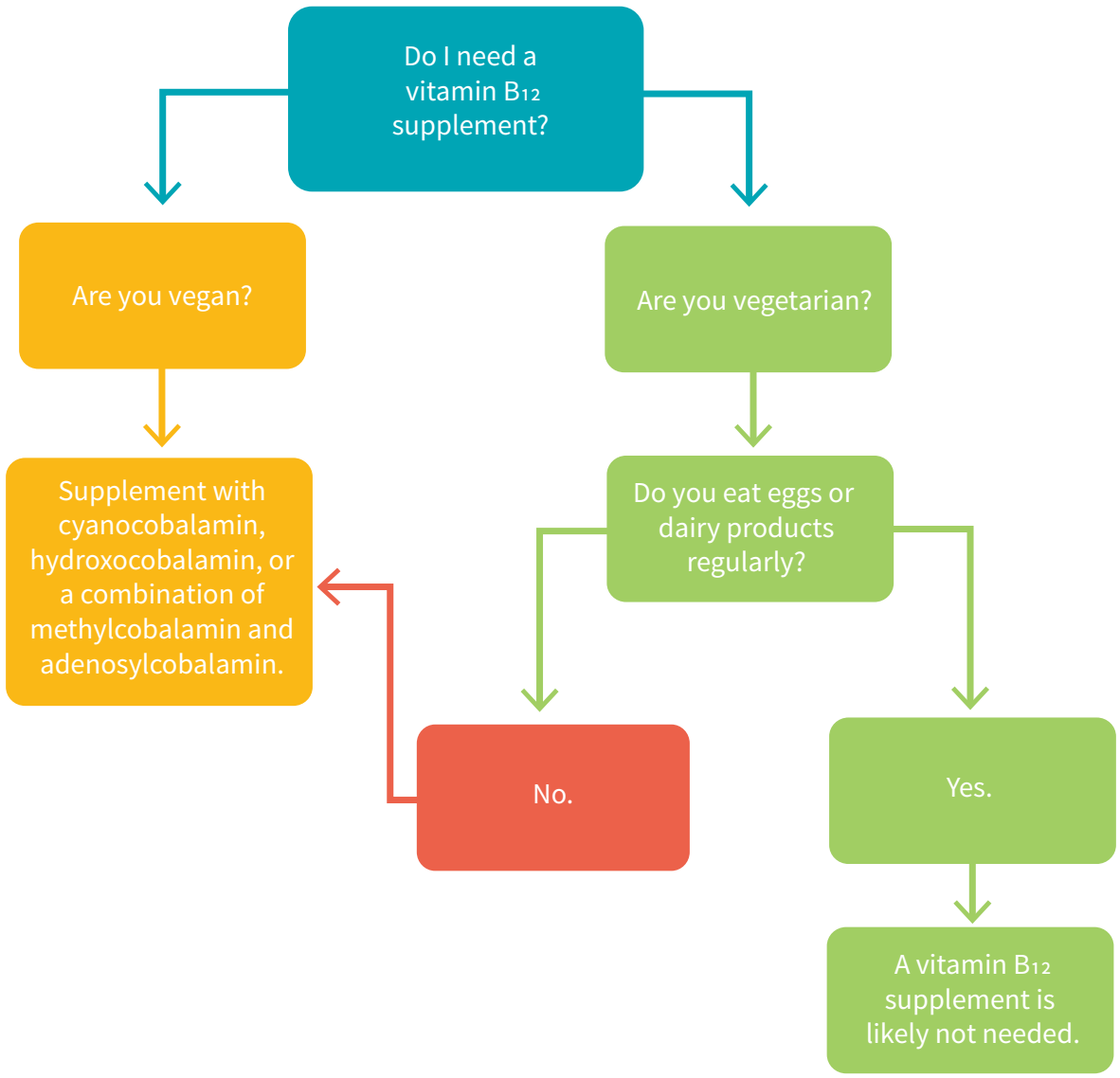
Cobalamin (B_{12}) deficiency can cause cognitive impairment, mood disorders, anemia, nerve damage, and other health problems. Vitamin B_{12} can be found in animal products, nutritional yeast, and some fortified foods.

B_{12} supplementation is recommended for **vegans** because natural sources of B_{12} are almost all animal-based. **Vegetarians** who regularly consume eggs or dairy products may not need to supplement B_{12}.

Each vitamin has different forms, called vitamers. Four B_{12} vitamers can be found in food: **hydroxo**cobalamin, **aqua**cobalamin, **methyl**cobalamin, and **adenosyl**cobalamin. Most supplements and fortified foods use the synthetic **cyano**cobalamin, which has the advantage of being particularly stable when kept away from bright light (UV rays in particular).

People with diabetic nephropathy or kidney problems related to diabetes should talk to their doctor before supplementing B_{12}.

Figure 3: Vitamin B_{12} decision flow chart



How to take it

Of the B_{12} vitamers most commonly supplemented, **cyano**cobalamin and **hydroxo**cobalamin can be taken on their own, but the bioactive **methyl**cobalamin and **adenosyl**cobalamin should be supplemented in combination. Most vegetarians and vegans will find **25–100 mcg/day** to be enough, while people over fifty or taking metformin could benefit from **100–400 mcg/day**. Your body will not absorb more than it needs: Dosages as high as 5,000 mcg/day (5 mg/day) have not been found to be toxic.

Primary Options

Iodine

Why it's a primary option

Iodine is a dietary mineral important for cognitive development in children and a properly functioning thyroid in all age groups. Too little or too much iodine can cause a decrease in thyroid hormone production, or even a goiter — an enlargement of the thyroid glands visible as a swelling of the front of the neck. Iodine can also counteract the decrease in thyroid hormone production caused by the goitrogens present in cruciferous vegetables (broccoli, kale …).

Women who plan to have children in the near future should keep an eye on their iodine intake, since iodine is important for fetal development.

Iodine is stored in body tissues, so a little can be found in animal products, but the main dietary sources are sea vegetables and iodized salt (in some countries, notably the United States, table salt is iodized by default). Iodine is a primary supplement in this guide because many vegetarians and vegans avoid table salt and processed foods (some of which contain iodized salt). If this is not the case with you, or if you frequently eat sea vegetables such as seaweeds, you probably do not need to supplement iodine.

How to take it

Take 75–150 mcg of iodine once a day, on an empty stomach or with a meal. Never take more than 500 mcg, unless so advised by your physician. In case of ferropenic anemia (iron deficiency anemia), adding iron to iodine can help address low thyroid hormone production.

The iodine content of seaweeds varies greatly, even within a same species, from less than 100 mcg/g to more than 8,000 mcg/g — a highly unsafe amount. Do not regularly consume high amounts of iodine-rich sea vegetables, such as paddle weed, oarweed, or kelp/kombu. Likewise, high amounts of iodine-rich sea vegetables in supplemental form should be avoided.

Iron with Vitamin C

Why it's a primary option

Like iodine, iron is a dietary mineral. It associates with proteins and enzymes to support many biological functions, such as energy production and DNA synthesis. Iron gets stored mostly in red blood cells, where it participates in oxygen transport.

Dietary iron exists as heme iron and non-heme iron. Plants, eggs, and dairy products only contain non-heme iron, as do nearly all iron-fortified foods. Not only is this form less bioavailable, its absorption rate is further reduced by a variety of compounds in food, particularly carbonates, fibers, oxalates, phytates, phosphates, and polyphenols. The polyphenols known as tannins (found notably in tea and coffee) are especially potent in that respect.

Of the few compounds known to *enhance* the absorption of non-heme iron, ascorbic acid (vitamin C) works best. However, while concomitant supplementation of iron and vitamin C strongly enhances the absorption of the former, simply adding vitamin C to one's diet barely improves one's iron status.

Since, compared to omnivores, vegetarians and vegans get little to no heme iron, they are more likely to suffer from iron deficiency. Because of monthly blood loss, premenopausal women are especially at risk — as are frequent blood donors.

It is important to remember, however, that while iron deficiencies are not rare, neither is iron poisoning (especially in children young enough to confuse iron tablets with candies). Without blood loss, there is hardly any iron loss, and while most people do not absorb more iron than they need (within certain limits), some genetic disorders (notably hemochromatosis) allow for unchecked accumulation.

How to take it

Women can supplement up to 18 mg of **iron**, except during pregnancy (27 mg) and after menopause (8 mg). Men should not supplement more than 8 mg.

Children and teenagers should not supplement iron without first consulting a doctor.

To facilitate absorption, take your iron dose with 250 mg of **vitamin C** (preferably on an empty stomach, except in case of gastrointestinal symptoms such as nausea, diarrhea, or constipation).

Avoid taking calcium, iron, magnesium, and zinc at the same time in combinations of 800+ mg, since high amounts of these minerals will compete for absorption. Iron may also impair the absorption of antibiotics (notably tetracyclines and quinolones) and of drugs used to treat osteoporosis, hypothyroidism, and symptoms of Parkinson's disease; so take iron and pharmaceuticals at least 6 hours apart.

Protein

Why it's a primary option

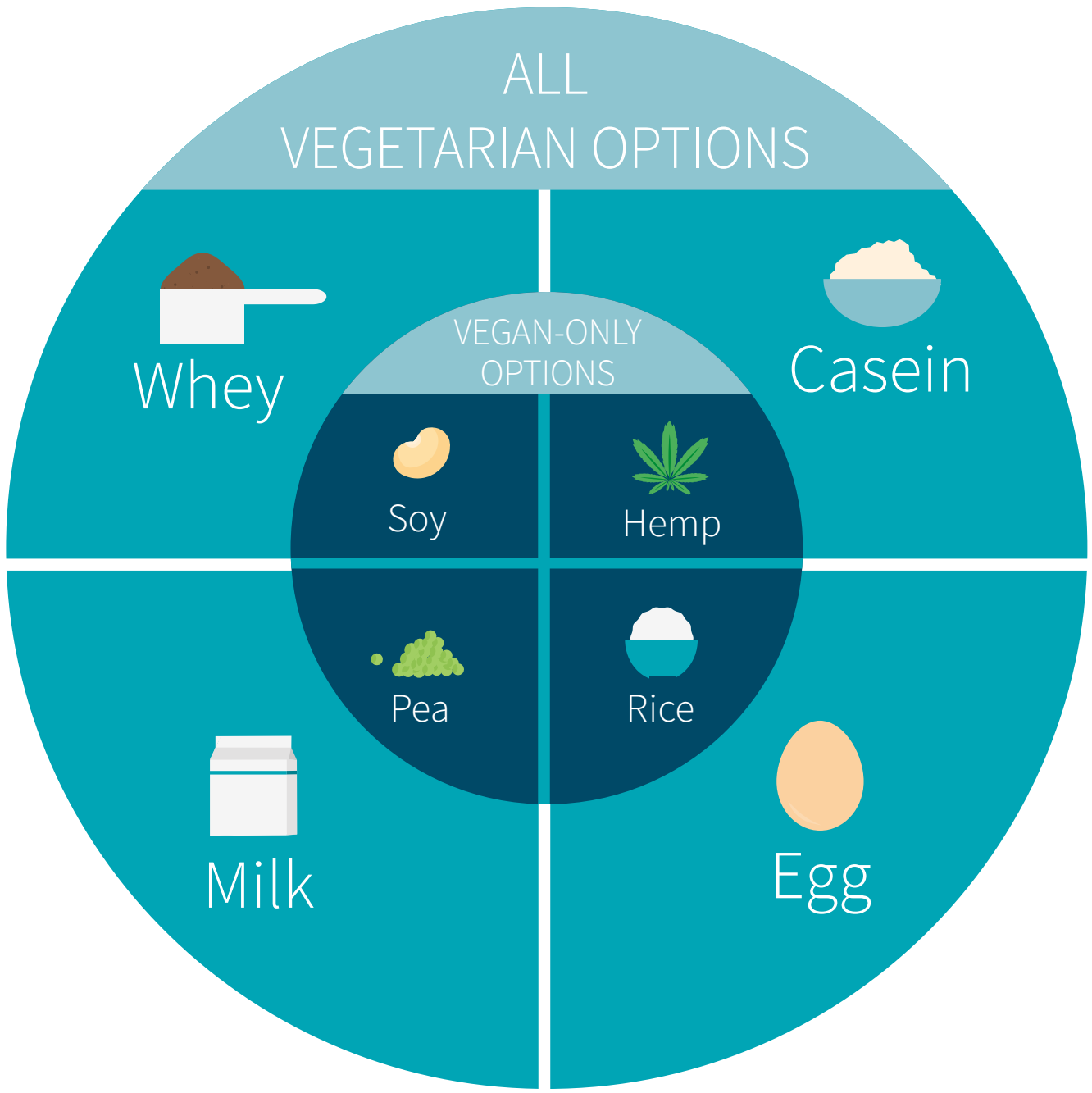
Dietary protein (the protein in food or supplements) plays important roles in the body, notably as a provider of *essential amino acids* (EAAs), which your body cannot synthesize. Unlike most animal proteins, most plant proteins are incomplete (they are poor in one or more EAAs). Moreover, compared to animal proteins, plant proteins tend to be less bioavailable (less protein is absorbed by the body). Vegetarians and vegans should pay particular attention to their protein intake, with an eye to both quantity and variety. Compared to omnivores, they are more likely to benefit from a supplement, preferably a powder.

Whey protein and casein powders are both derived from milk protein (which is 20% whey and 80% casein). If you are neither lactose intolerant nor vegan, look for a whey protein concentrate that is at least 80% protein. Whey protein is cheap and very anabolic (good for building muscle). Micellar casein is more expensive but more anti-catabolic (good for preserving muscle). Since micellar casein digests slowly, it is often seen as the ideal protein to consume before sleep.

But what if you are lactose intolerant or vegan? Fortunately, you can still supplement protein powders. Whey protein isolates contain very little lactose. For vegans, two popular options are soy protein, a complete protein, and a 70:30 pea:rice protein blend, which is seen as the vegan alternative to whey protein due to their similar amino acid profiles. Depending on processing techniques, the estrogenic isoflavone content can be greater in a soy protein

isolate than in a soy protein concentrate, but it is still too small to elicit any significant hormonal response when as much as 200 g of soy protein isolate is consumed each day.

Figure 4: Vegetarian- and vegan-friendly protein sources



Hemp protein is not a complete protein. Moreover, hemp protein powders are about half protein, the rest being mostly fiber and fat (18% ALA). As a protein supplement, hemp ranks below the options listed above.

Two-thirds of spirulina is protein. As with hemp protein, however, spirulina protein is not complete. Furthermore, in high doses (25+ g), spirulina can be very active in the body, in ways that are still uncertain. Therefore, it should not serve as a mainstay protein supplement.

How to take it

In the United States, the recommended daily allowance (RDA) for protein is 0.8 g per kilogram of body weight (0.36 g/lb/day). This amount will allow most sedentary adults to maintain muscle mass without losing or gaining weight, but recent research suggests that people with fitness goals can benefit from more. For active people, both 1.2–2.0 g/kg/day (0.54–0.91 g/lb/day) and 1.4–2.0 g/kg/day (0.64–0.91 g/lb/day) have been recommended. If your goal is to lose fat, aim for at least 1.0–1.5 g/kg/day (0.45–0.68 g/lb/day), and ideally 1.5–2.2 g/kg/day (0.68–1.00 g/lb/day).

Table 2: Daily protein intake

Body weight	0.36	0.45	0.54	0.64	0.68	0.91	1.00	g/lb
	0.8	1.0	1.2	1.4	1.5	2.0	2.2	g/kg
100 lb (45 kg)	36	45	54	64	68	91	100	g
150 lb (68 kg)	54	68	81	96	102	137	150	
200 lb (91 kg)	72	91	108	128	136	182	200	
250 lb (113 kg)	90	113	135	160	170	228	250	

Unless you have a pre-existing condition that affects your liver or kidneys, the intakes in the above table will not harm those organs. However, if you have a BMI of more than 30, you may want to calculate your protein requirements based on your goal body weight rather than your current body weight, so as to avoid overeating.

Consume 20–40 g of protein within the two hours preceding or following your workout to help stimulate muscle growth. Consume 20–40 g of protein before bed to help stimulate muscle growth or at least reduce muscle breakdown while you sleep. Spread the rest of your intake over a few meals, starting with breakfast, so as to ease digestion and provide your body with a consistent flow of amino acids.

Vitamin D

Why it's a primary option

Suboptimal levels of vitamin D are common, especially in people whose exposure to sunlight (without clothes or sunscreen) is limited. Moreover,

the darker your skin, the longer you need to expose yourself to sunlight to synthesize enough vitamin D. Very little vitamin D can be found naturally in foods, with fatty fish being a notable exception (particularly cod liver oil).

In the United States and other countries, milk is commonly fortified with either ergocalciferol (D_2) or, more recently, cholecalciferol (D_3). Why milk? Because vitamin D helps your body better absorb calcium. For the same reason, cereals fortified with D_2 or D_3 are also common.

D_2 is obtained through the irradiation of some plants and fungi. This is how some commercially available mushrooms contain D_2. Soy milk is often fortified with D_2, as well as with calcium. And of course, D_2 is available in supplement form.

Alas, D_2 is not as bioavailable as D_3, which means your body cannot use it as readily. Moreover, D_2 is not as stable as D_3; it is more likely to degrade with time and variations in temperature and humidity.

D_3 is the kind of vitamin D your body synthesizes from the cholesterol in your skin under the action of the sun's ultraviolet B (UVB). As a supplement, it is most often derived from lanolin, a waxy substance secreted by the skin glands of woolly animals. Sheep are sheared, then the lanolin coating is squeezed off the wool. Since the sheep are not killed in the process, this source of D_3 will be acceptable to some vegetarians. For vegans, the only acceptable D_3 supplement will be the more expensive Vitashine, a proprietary lichen extract.

How to take it

Take 2,000 IU (50 mcg) of **D_3** with a meal containing fat, either year round or only during the colder, darker months, when you are least likely to synthesize enough vitamin D from sun exposure. If you spend a lot of time outside and live near the equator, supplementation is probably never a necessity.

Doses higher than 2,000 IU may be warranted in cases of severe deficiency or non-response at lower doses, as ascertained by a blood test. Keep in mind that, over months, 10,000 IU/day can become toxic.

Secondary Options

Beta-Alanine

Why it's a secondary option

When ingested, the nonessential amino acid beta-alanine binds with the essential amino acid histidine to create carnosine. Carnosine has anti-aging and antioxidant properties; it also buffers lactic acid during exercise, which delays muscle fatigue.

The body cannot synthesize enough carnosine without enough beta-alanine, and it cannot synthesize enough beta-alanine to compensate for a dietary deficiency. Since beta-alanine and carnosine can only be found in meat products, vegetarians and vegans have lower than optimal carnosine levels (as do elderly people) and may benefit from beta-alanine supplementation.

How to take it

Take 4–6 g/day. While beta-alanine can be taken at any time of the day, it may be better absorbed with a meal.

A common side-effect of beta-alanine is paresthesia (a tingling sensation, as when your leg "falls asleep"). Taking smaller doses throughout the day or using time-release formulations can help reduce the prickling sensation on the face and skin. Paresthesia is harmless, if unpleasant.

Inadvisable Supplements

Omega 3-6-9

Your body can make omega-9 fatty acids when it needs them, and you probably get more than enough omega-6 fatty acids through your diet. The only kind of polyunsaturated fatty acids you might lack are omega-3 fatty acids, so you should not purchase "omega 3-6-9" supplements.

Assembling Your Stack

Incorporating Core Supplements

With a meal, take vitamin B_{12} (25–400 mcg), algal oil softgels (650 mg of combined EPA and DHA), creatine (2–5 g), and carnitine — either acetyl-L-carnitine (250–500 mg) for neurological benefits or L-carnitine (2 g) for non-neurological benefits.

Incorporating Options

For vegetarian and vegan athletes

Take beta-alanine (4–6 g) with the core supplements.

Acetyl-L-carnitine *might* improve focus when taken 30–45 minutes before exercise.

For vegetarians and vegans who want to add more protein to their diet

Whole foods are best, but if you cannot tweak your diet to cover your daily protein needs, add 20 g of a vegetarian or vegan protein powder to the core supplements. Progressively increase this dose as needed. The greater the dose, the greater the benefit from spreading it over several meals.

For vegetarians and vegans avoiding salt

Take iodine (75–150 mcg) with the core supplements.

If you consume sea vegetables or iodized salt (either by itself or as an ingredient of processed foods), you probably do not need to supplement iodine.

For vegetarians who don't get enough sun

With a meal containing fat, take vitamin D_3 (50 mcg / 2,000 IU) in the form of an algal extract.

FAQ

Can I add to my stack a supplement not covered in this guide?

Supplement your current stack for a few weeks before attempting any change. Talk to your doctor and research each potential new addition in advance. Check for known negative interactions with other supplements in your current stack, but also for synergies. If two supplements are synergistic or additive in their effects, you might want to use lower doses for each.

Can I modify the recommended doses?

If a supplement has a recommended dosage range, stay within that range. If a supplement has a precise recommended dose, stay within 10% of that dose. Taking more than recommended could be counterproductive or even dangerous.

Should I take my supplements with or without food? In the daytime or the evening?

Answers are provided in each supplement entry whenever the evidence permits. Too often, however, the evidence is either mixed or absent. Besides, a supplement's digestion, absorption, and metabolism can be affected differently by different foods. Fat-soluble vitamins (A, D, E, K), for instance, are better absorbed with a small meal containing fat than with a large meal containing little to no fat.

Starting with half the regular dose can help minimize the harm a supplement may cause when taken during the day (e.g., tiredness) or in the evening (e.g., insomnia).

What's the difference between elemental iodine/iron and other kinds of iodine/iron?

"Elemental" refers to the weight of the mineral by itself, separately from the compound bound to it. For instance, consuming 13 mg of potassium iodide means consuming 10 mg of elemental iodine, whereas consuming 100 mg of ferrous fumarate means consuming 33 mg of elemental iron. ***Product labels display the elemental dosage.*** On a label, "100 mcg of iodine (as potassium iodide)" means 100 mcg of elemental iodine (and 30 mcg of potassium), whereas "8 mg of iron (as ferrous fumarate)" means 8 mg of elemental iron (and 16 mg of fumaric acid).

Since the body makes carnosine out of beta-alanine and histidine, should I also supplement histidine?

It isn't necessary. If you consume enough protein, your muscles already have all the histidine they need to produce more carnosine.

Still, why beta-alanine? Wouldn't it be simpler to supplement carnosine directly?

Since carnosine simply gets digested into beta-alanine and histidine, and since your muscles already have enough histidine, carnosine supplementation has no advantage over beta-alanine supplementation — especially since beta-alanine is cheaper.

Why is there no mention in this guide of greens supplements?

Barley, chlorella, spirulina … Many are the plant-based supplements aimed at vegetarians and vegans. Some may be useful — for instance, preliminary evidence suggests that spirulina can fight inflammatory diseases. However, none of those "greens" products benefit vegetarians or vegans more than omnivores, so none were included in this guide.

Precautions and Troubleshooting

Stack components are seldom studied together. The safest way to add supplements to your daily routine is one at a time, at least a couple of weeks apart, to better assess the effects (and side effects) of each new addition. Start at half the regular dose for a week, then slowly increase to the regular dose if you are not experiencing the desired effects.

Since minerals and vitamins (especially the fat-soluble vitamins: A, D, E, and K) can accumulate in the body, it is best to consider supplementation only after a dietary evaluation. Track what you eat for a week; if, on average, you are getting less than 80% of your Recommended Dietary Allowance or Adequate Intake, supplementation becomes an option, though first you should try eating more foods rich in the desired vitamin or mineral.