

Plant-Based Protein Guide

Complete sources, timing, and absorption — evidence-based

Protein adequacy on a plant-based diet is achievable, but it requires attention to amino acid completeness, total daily intake, and timing relative to training. This guide covers the research on protein quality, the best plant sources by gram-per-calorie, and the practical protocols that the evidence actually supports.

1. Why Amino Acid Completeness Matters

Animal proteins are complete, meaning they contain all nine essential amino acids in ratios that match human requirements. Most plant proteins are incomplete. The limiting amino acids in common plant foods are: lysine (grains, nuts), methionine (legumes), and tryptophan (some seeds). A 2016 study in the *Journal of the International Society of Sports Nutrition* established that the leucine threshold to trigger muscle protein synthesis is approximately 2–3g per meal — many plant sources require larger serving sizes to reach this threshold.

2. Best Plant Protein Sources

- **Tempeh**
31g / 100g. Complete amino profile. Highest protein density of any whole plant food. Fermentation adds probiotics and vitamin K2.
- **Edamame**
18g / 100g cooked. Complete. High leucine relative to other legumes. Most validated plant protein for muscle synthesis.
- **Lentils**
9g / 100g cooked. Low methionine, high lysine. Pairs with rice or seeds to complete the profile. High iron and folate.
- **Hemp seeds**
10g / 30g. Complete protein with favorable omega-3 ratio. Requires no cooking.
- **Pea protein (powder)**
~24g / 30g. Near-complete. A 2015 RCT in *JISSN* found pea protein equally effective as whey for muscle thickness gains in resistance-trained men.
- **Quinoa**
8g / 185g cooked. Complete grain protein. High magnesium and manganese.
- **Nutritional yeast**
8g / 2 tbsp. Complete. Provides B12 in fortified versions.

3. Daily Intake Targets

Research suggests plant-based athletes need approximately 1.6–2.0g protein per kg of bodyweight — higher than omnivore guidelines — to compensate for lower DIAAS scores (0.5–0.75 for plant proteins vs. 1.0–1.2 for animal proteins). Distribute intake across 3–5 meals of 25–40g each rather than concentrating in one or two meals.

Targets by Goal

Goal	g/kg/day	Notes
General health	1.2 – 1.4	Maintenance
Muscle building	1.6 – 2.0	Upper range for plant-based
Fat loss	1.8 – 2.2	Preserve lean mass in deficit
Endurance sport	1.4 – 1.7	Recovery focus

4. Combining for Completeness

- **Rice + lentils**

Rice provides methionine, lentils provide lysine. Complete profile at 2:1 cooked weight ratio.

- **Corn + black beans**

Mesoamerican staple. Corn is high in methionine and cysteine; beans are high in lysine.

- **Pea + rice protein powder**

The basis of most commercial plant protein blends. Complementary limiting amino acids.

- **Seeds + any legume**

Hemp, pumpkin, or sunflower seeds added to any legume meal close amino acid gaps effectively.

5. Timing and Absorption

A 2022 review in *Nutrients* confirmed that 25–40g of plant protein within two hours post-exercise produced comparable muscle protein synthesis to equivalent whey doses when leucine content was matched. If whole-food sources fall short of the leucine threshold, adding 1–3g of leucine powder to a meal is a practical and validated strategy.

Sample Day: 2,000 kcal Plant-Based

Breakfast	Oats + hemp seeds + edamame	~30g
Lunch	Lentil + quinoa bowl + nutritional yeast	~35g
Snack	Tempeh strips + pumpkin seeds	~25g
Post-workout	Pea/rice protein shake	~30g
Dinner	Black bean tacos + corn tortilla + seeds	~28g
Total		~148g

Plant-based protein adequacy requires intention, not complexity. Prioritize complete or complementary sources, track total intake relative to your bodyweight, and distribute protein across meals. The evidence supports equivalent outcomes to omnivore diets when these principles are consistently applied.